

Design Engineering

PUBLISHED BY THE MACLEAN HUNTER PUBLISHING GROUP

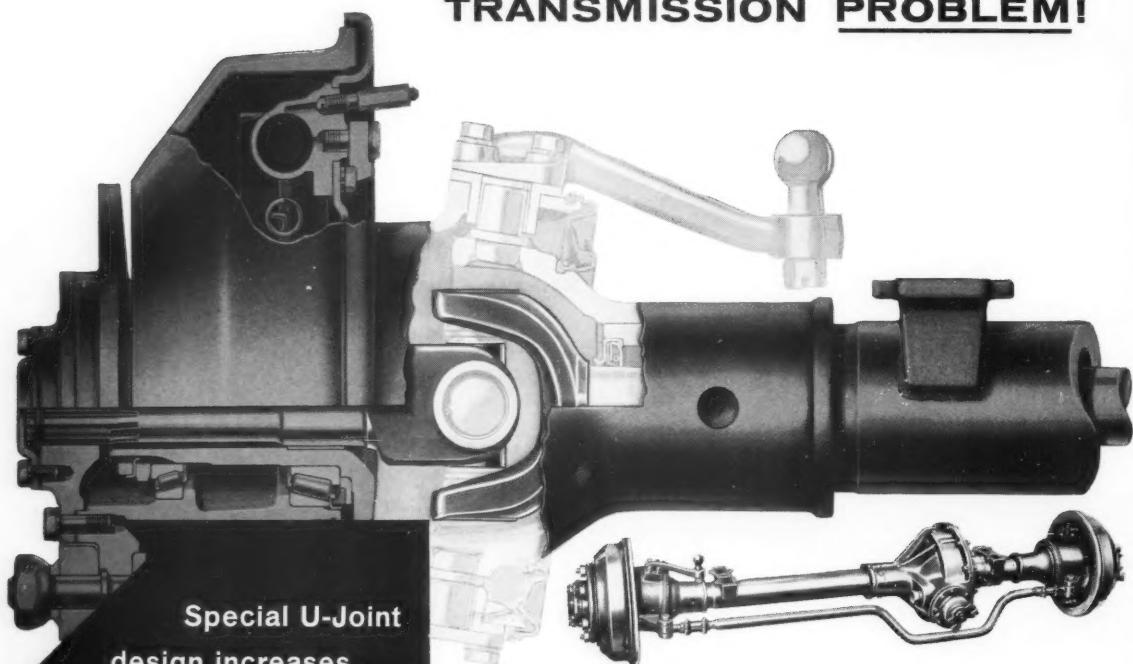
JAN 8 1967

JAN 8 1961

Blueprints for the future

BLOOD BROTHERS UNIVERSAL JOINT

**SOLVES ANOTHER POWER
TRANSMISSION PROBLEM!**



Special U-Joint
design increases
axle torque capacity...
yet lowers axle
production
costs!

Working with a major manufacturer of truck axles, Rockwell-Standard engineers developed a new design for a front steering, driving axle that uses a single carden universal joint in place of the expensive and complicated constant velocity type previously used on a special all-wheel-drive vehicle.

The result: An axle that provides substantially increased torque capacity . . . at a considerable savings in manufacturing costs!

Whether you are designing a new product or seeking to improve an existing one, consult Rockwell-Standard engineers for specialized help in meeting your universal joint needs. Chances are, a Blood Brothers product will not only increase performance — but save you time and money as well.

For further product information write for Bulletin

Another Product of...

ROCKWELL-STANDARD
CORPORATION



Universal Joint Division, Allegan, Michigan

For further information mark No. 152 on Readers' Service Card



This month's cover
Little did the engineers and draftsmen of fifty years ago suspect the high level to which their technology would advance. Simplified drawing practice, new equipment and materials, and automated print handling call for the future approach. One technique that is still with us, however, to some extent, but which may soon be passing entirely from the draftsman's skill is the use of pen and ink. Ron Vickers, A.R.P.S., has blown up (photographically, of course!) a hairline, with the ink still wet, and the tip of the drawing pen as it makes its way across the sheet of tracing paper. Magnification is approximately 50 times.

In this issue

43 Drafting standards, the foundation for all good standards programs **Gordon Wells**
A standard specialist gives pointers on how to establish a successful drafting system.

47 Are draftsmen downgraded in Canada?
The Canadian way results in a waste of engineering talent, according to a man who has had experience of the British system.

48 Double trouble with double dimensions **W. E. Dayer**
The practice of putting extra dimensions on a drawing not only wastes time, it can mean the loss of costly components.

51 Shortcuts for drawing gear teeth
It's a problem that regularly confronts the draftsman, and here are some expert suggestions to solve it.

52 Automating the drawing office saves \$\$\$
How Westinghouse did it and saved two ways. Here's a case history that cannot fail to benefit you and your company.

56 A new drawing system makes its bow **Wayne L. Shick**
A university professor explains a system he developed himself, a direct method of drawing between views and a faster automatic process for isometrics.

64 What should Canadians do to increase exports?
Here's another round-up of views in our popular Opinion Poll. This month's viewpoints on a burning issue come from both top management and designers.

58 Preferred numbers simplify design size decisions
Describes a system in which all designers would use uniform sizes. The system would create the interchangeability needed for successful standardization.

62 Will the Blue Goose win world markets? **George Harry**
The Blue Goose is the Canadian diesel-hydraulic locomotive with remarkable design features.

66 Microfilm system cuts searching time 90%
Want product information in a hurry? Here's the story on a microfilm catalogue service that really cuts wasted time.

Departments

Backlash	94
Briefs	81
Contributors	3
Designews in pictures	60
Ideas round-up	72
Letter to the editor	85
New products	76
Overheard in Ottawa	68
People and events	86
Reader Service Card	97
Reports	5
Technical literature	71

Reader Service

Before reading further, turn to the back of the book and tear out a Reader Service Card. Circle the numbers as you go and mail the completed card to us—no postage is required. We will take care of your requests immediately.

Pass your copy along so that others may enjoy this service—there are three cards.



There's no end of possibilities with

STEEL TUBING
by STANDARD TUBE

Aluminum Sheet,
Bar, Extrusions,
Tube and Wire
also available in
any quantity.



STANDARD TUBE AND T.I. LIMITED

WOODSTOCK - HAMILTON - TORONTO - OTTAWA - MONTREAL - VANCOUVER
AGENTS IN OTHER PRINCIPAL CITIES

For further information mark No. 157 on Readers' Service Card

The staff

A. Douglas Kaili
B.Sc., M.E.I.C., P.Eng.
EDITOR

George Harry
ASSISTANT EDITOR

Gordon Duffy
MONTREAL EDITOR

Richard Gwyn
OTTAWA EDITOR

Robert A. Metcalfe
BRITISH COLUMBIA EDITOR

Raymond A. Tulloch
MANITOBA EDITOR

George McKechnie
ADVERTISING REPRESENTATIVE

Charles E. Laws, B.J.
EASTERN REPRESENTATIVE

J. A. Walters
U. K. ADVERTISING MANAGER

Frank Davies, M.T.D.C., M.S.I.A.
EDITORIAL ART DIRECTOR

John F. Foy
CIRCULATION MANAGER

J. W. Sargent
MANAGER, ADVERTISING PROMOTION

W. A. Weir
ADVERTISING SERVICE MANAGER

D. van Rij
ADVERTISING PRODUCTION

Murray Mark
MANAGER, VANCOUVER OFFICE

Ronald A. Smith
MANAGER

George W. Gilmour
GROUP MANAGER
INDUSTRIAL PUBLICATIONS

J. L. Craig
VICE PRESIDENT AND DIRECTOR
BUSINESS PUBLICATIONS DIVISION

★ ★ ★ ★

Design Engineering

ICCA

Printed and published by Maclean-Hunter Publishing Company Limited. Editorial and Advertising Offices: 481 University Avenue, Toronto 2, Canada. Horace T. Hunter, Chairman; the Hon. Floyd S. Chernes, President; Donald F. Hunter, Vice-President and Managing Director.

OTHER SERVICES: The Financial Post Corporation Service; Canadian Press Clipping Service; Commercial Printing Division.

Offices at 1242 Peel Street, Montreal 2; The Burrard Building, 1036 West Georgia Street, Vancouver 3; Maclean-Hunter Limited, 30 Old Burlington Street, London W.1, England.

Subscription rates: Canada \$4.00 per year; two years \$8.00; three years \$13.00. Single copy, 50¢. United States and Great Britain \$10.00 per year. Other countries \$20.00 per year.

Authorized as second class matter. Post Office Department, Ottawa.

The contributors

This month's contributors are all keen writing men. And if you think that applies to all our authors month after month, you're dead wrong! Sometimes we have to wheedle, grovel and snarl in turn to get an article completed by deadline.

But this month's contributors, as we say, are all men who like to write, and for once neither cajolery nor threats were needed. All are used to bylines in one form or another, on magazine articles, on pamphlets or monographs and even in books. To all of them a writing commission is a sacred thing. They would no more break a deadline than a cabby would refuse a tip.

Wayne Shick, for instance, the University of Illinois professor who describes a revolutionary new drafting technique, is co-author of a book on Geometry for Architects and one on Problems in Geometry for Architects. He contributed a chapter to a book on Engineering Drawing and Geometry. He is the editor of Engineering Graphics, which is the publication of the Engineering Graphics Division of the American Society for Engineering Education.

Prof. Shick is Professor in General Engineering in the university's College of Engineering. He graduated from the same university in 1940 with a B.S. Architecture degree and then did his war service, including a spell with the airborne troops in New Guinea, before joining the university staff in 1945. He and his wife Louise have three children, David and Randy aged 13 and 10, and Julia Ann aged four.

Next we have **William Dayer**, the draftsman-designer who contributes the piece on double dimensioning. Bill, who works for Sheldons Engineering Ltd., Galt, Ont., came to this country in 1957, bringing with him 15 years' skill acquired in England. One of his jobs there was training officer for a machine tool firm, and it was this that got him started on writing.

As part of the training program he had to lecture student draftsmen and it occurred to him that his notes would make good material for magazine articles in the technical press. His first submission, much to his own surprise, was accepted and he's never looked back since. With the years he has added skill in taking pictures, either to illustrate his articles or to produce purely pictorial features.

Bill and his wife, both born in Bir-



Wells



Dayer



Shick

mingham, have one son, born in Wales. Their second child will be born in Canada within a matter of weeks.

Gord Wells, who wrote the article on standardization in drafting, is a nationally known expert in standards. He works for Canadian General Electric, for whom he has established standardization programs in three separate plants. He has served on innumerable interplant committees for the production of manuals for use by CGE employees. Committees he has served, often as chairman or secretary, include mechanization, small tool, quality control, materials handling, value analysis, machine finishes, etc.

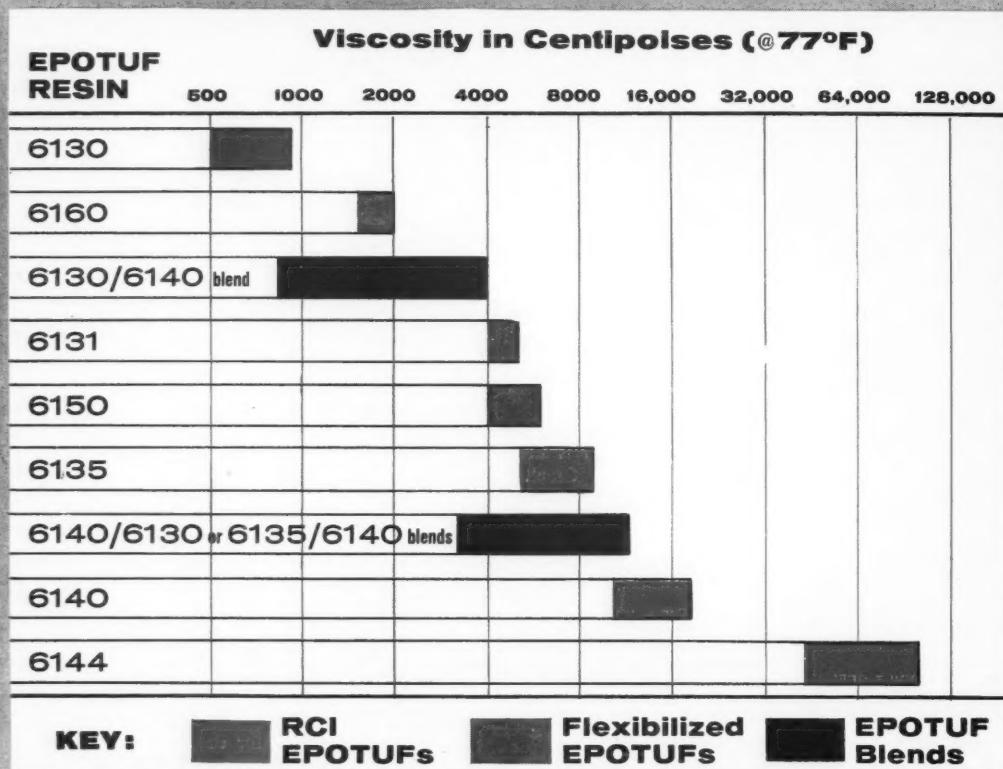
Currently he is serving his second term as chairman of the Hamilton-Toronto section of the Standards Engineers Society, which he helped to organize. He has served on industry and national committees of the Canadian Standards Association and the Electronic Industries Association (successor to RETMA). He is also chairman of the Prime Contractors Engineering Committee of the EIA.

A native of Nova Scotia, Gord makes an annual pilgrimage with his wife to wander round the towns and villages, soaking up the legend and history and enjoying the fine sea foods. These trips provide subjects for his oil paintings and color slides. His family have grown and moved on; the two daughters are married and the son is in the Air Force.

RCI Epotuf Epoxy Resins

Meet Every Viscosity Need

CHOOSE THE RIGHT EPOTUF RESIN FOR YOUR NEEDS
FROM THIS VISCOSITY SELECTOR CHART:



RCI Epotuf epoxy resins offer all these advantages:

- Complete viscosity coverage — your choice of resins to meet specific viscosity needs
- No diluents required to make the resin you choose work in your application
- Resin performance is consistent — variables need not be introduced on the production line
- System standardization is possible
- Production-line time is saved
- A unique production process yields RCI

EPOTUF epoxy resins that are extremely clear, light in color and highly purified. Hydrolyzable chlorine is at a minimum; and resins for the electrical industry can be guaranteed to contain well below the amount found in the standard specifications of the trade. Because of exceptional quality control, RCI epoxy resins have superior consistency properties from batch to batch. Write today for complete technical information on RCI EPOTUF resins.

*Creative Chemistry . . .
Your Partner
in Progress*



REICHHOLD

Synthetic Resins • Chemical Colors • Industrial Adhesives • Phenol
Hydrochloric Acid • Formaldehyde • Phthalic Anhydride • Maleic Anhydride
Ortho-Phenylphenol • Sodium Sulfite • Pentaerythritol • Pentachlorophenol
Sodium Pentachlorophenate • Sulfuric Acid • Methanol

REICHHOLD CHEMICALS (CANADA), LTD. • 1919 Wilson Ave. (Weston), Toronto 15, Ontario

For further information mark No. 150 on Readers' Service Card

Reports — A world roundup of engineering and design interest

Man produces light a million times brighter than the sun



Scientists at the Bell Telephone Laboratories have used an "optical maser" to experiment in long-distance communications. The maser (an acronym for Microwave Amplification by Stimulated Emission of Radiation) produces a narrow, intense beam of light more than a million times brighter than the sun. Its beam is "coherent," thus there is a definite phase relationship from point to point in all its parts. In radio waves it is coherence which makes it possible to control the waves, so scientists are hopeful that coherent light may be used in the same way. Besides transmitting information, it may have other applications such as improved standards of length. Picture shows two Bell scientists directing the light 25 miles away, where it is received on a phototube. It was visible to the naked eye.

Circle 300 on Reader Service Card

Canadian idea in "instant" tarpaulin attracts U.S. press



This column is happiest when at least half the space is occupied by Canadian design and engineering ideas, which unfortunately is not often. There's only one this month. How many there'll be next month depends on you. This month's solitary idea is a new concept in truck tarpaulin units, a kind of "instant" tarpaulin. It converts a pickup into a panel truck in seconds and, more important, can be operated by one person. Known as the "Griffin-Top," it operates on a principle similar to the trellis. The idea received publicity in the January and February issues of U. S. magazines of the Popular Science type, but the manufacturers report that they have not yet had national Canadian coverage, only local publicity in Calgary, where it was developed. They plan to license manufacturers in the United States and Eastern Canada.

Circle 301 on Reader Service Card

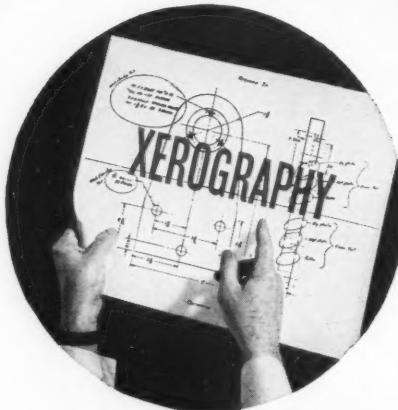
Contractors at last get prefabricated brick walls



Prefabrication has long been a dream of the construction industry, yet it made little progress in this direction. Now comes the Structural Clay Products Institute with a prefab brick wall, the same brick that has sheltered man through the ages. The panels were used in a Chicago store after extensive tests. The building contains 2,052 sq ft of brick panel incorporated in 27 preassembled units each 19 x 4 ft. The sawtooth brick wall specified by the architects would have been 12 in. and in some places 16 in. thick, but the building panels did the job with only 2½ in. Tests show that this thickness is more than adequate. Building panels are expected to be nationally available in 12 months.

Circle 302 on Reader Service Card

Use any
reproduction
process . . .



Your drawings reproduce sharper, clearer with Eagle Turquoise



TURQUOISE LEAD HOLDERS hold any TURQUOISE lead (5B to 9H).



TURQUOISE DRAWING PENCILS are made in 17 degrees, 6B to 9H.



TURQUOISE WITH ERASER, in grades 4B to 6H, is increasingly popular as a field tool.

Whatever the process, you'll get sharper, clearer prints if you use an Eagle TURQUOISE. Lines are more opaque and also blacker—because the graphite in TURQUOISE is finer-ground with denser-packed particles.

Get smoother, neater drafting, too! TURQUOISE glides

effortlessly, evenly over paper, cloth, vellum, "Mylar"®. And uniform grading means consistent peak performance.

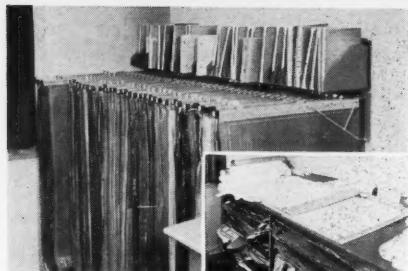
So, no matter what you draw on, how you reproduce it, use Eagle TURQUOISE for superior results every time!

WANT A FREE SAMPLE? Write for a TURQUOISE pencil or lead, in the degree you'd like to test on your favourite drafting material. Eagle Pencil Company of Canada Ltd., 217 Bay St., Toronto 1.

For further information mark No. 125 on Readers' Service Card



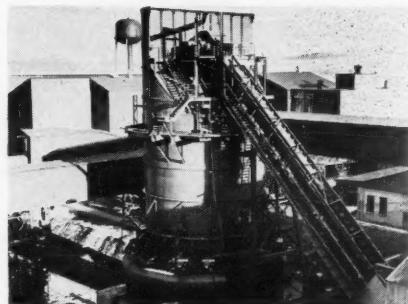
Filing system locates plans quicker, prevents them from creasing



First look at the inset photograph. How could you find the plans you need in those crowded shelves? If you did, chances are that they're dog-eared and wrinkled. Let's face it, a filing system like that wastes your time and runs up your overhead. Now transfer your attention to the other view. Here the plans hang clean, flat, ready for instant identification. This "Plan Hold" file system will accommodate 1,200 plan sheets in an area only 24 inches across. The system is made by a manufacturer of filing equipment.

Circle 303 on Reader Service Card

New sinter cooler is stationary, gives longer exposure



A new sinter cooler, the first of its type, has gone into operation at one of the Jones & Laughlin Steel Corporation's mills. It differs from the conventional type of rotating cooler in that it is stationary, the sinter being cooled by blasts of air as it works down through a vertical shaft. The cooler gives the sinter a longer exposure for cooling, as much as 1½ hrs compared with 15 to 20 minutes in a circular cooler. Sinter can then be loaded direct from the cooler into railroad cars. Shaped like a blast furnace, the cooler has a rated capacity of 3,800 gross tons per day and a diameter of 44 ft at its widest point. The installation also includes new breaking and screening facilities for the plant's two 6-ft-wide winter machines.

Circle 304 on Reader Service Card

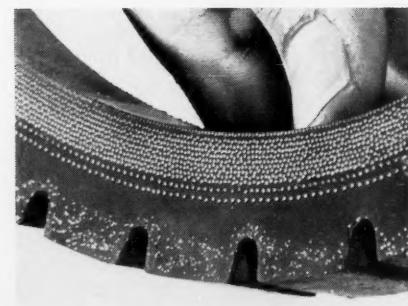
Hearing aid shuts out crowd noises, gives one voice at a time



These eyeglass frames have a built-in hearing aid of a distinctive type. From all the babble of a crowded hall, it lets the wearer distinguish the voice of the person facing him. Thus for the first time hearing aids can be effectively used at conventions and parties; for the first time the wearer is protected from a sea of sound coming from all directions. Though revolutionary in its effects, the new hearing aid is incredibly simple in design. The conventional hearing aid has the microphone in the sidepieces. In the new frame, the microphone is in the bridge, and this "up front" position brings in the person directly in front more clearly than surrounding conversations and noises. The microphone picks up the wanted voice and tiny wires buried in the frame carry it to full-range hearing aids built into the sidepieces.

Circle 305 on Reader Service Card

Bits of wire increase tirelife, cut blowouts

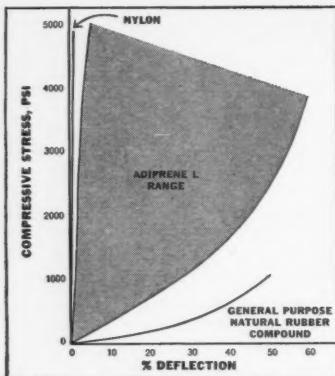


Jet planes landing at speeds up to 250 mph roll to a smooth stop more safely with the help of wire cut to precisely specified lengths and molded into the tire treads. The cut wire does several things. It increases tire life. It dissipates much of the heat that would otherwise build up at high landing speed, thus cutting the chance of a blowout. It protects the tread from small breaks caused by stones and sharp edges. And it permits thinner treads and so minimizes the danger of tread being blown off the tire by centrifugal force. The wire is demagnetized to keep it from bunching together. It is mixed into the tread compound before the tire is molded and cured. A typical tire uses brass-plated carbon steel wire about twice the thickness of human hair.

Circle 306 on Reader Service Card

ADIPRENE* L

new Du Pont liquid urethane elastomer

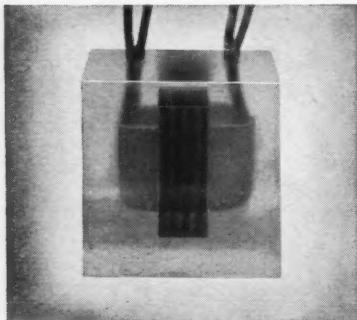


CARRIES A HEAVY LOAD

An outstanding attribute of this new Du Pont synthetic rubber is its combination of toughness, high load-carrying ability and resilience. Load-bearing capacities of hard ADIPRENE L compounds far excel those of general purpose synthetic rubbers.

RESISTS ABRASION

Both in the laboratory and in actual service, ADIPRENE L has demonstrated its ability to resist wear. On industrial wheels it has outlasted natural rubber as much as 10 times . . . has more than doubled service in pump impellers handling abrasive slurries.



NOT BRITTLE AT "EIGHTY BELOW"

ADIPRENE L vulcanizates maintain their resilience at -20° F. . . . and do not become brittle at temperatures as low as -80° F. They exhibit outstanding resistance to thermal shock, and will operate at intermittent temperatures as high as 250° F.

OTHER PROPERTIES

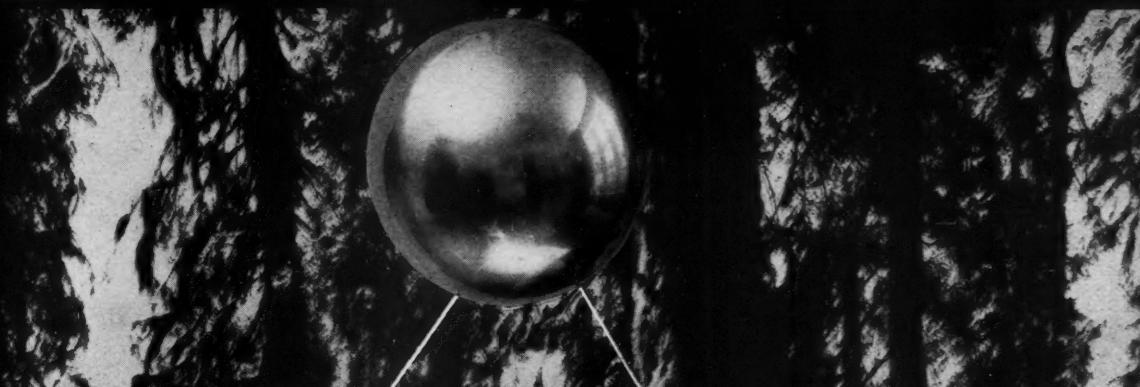
Products made from ADIPRENE L are available in various hardnesses from 10 to 99 Shore A (78 Shore D). They resist the action of lubricating oils, greases, weak acids, alkalies, as well as oxygen, ozone and radiation. Suggested uses for ADIPRENE L include industrial rolls, motor mounts, seals, potting compounds, solid tires, striker plates, wear-resistant linings and coverings. Write for booklet on properties and applications of this new material. Du Pont of Canada Limited, Elastomer Chemical, 85 Eglinton Avenue East, Toronto 12, Ontario.



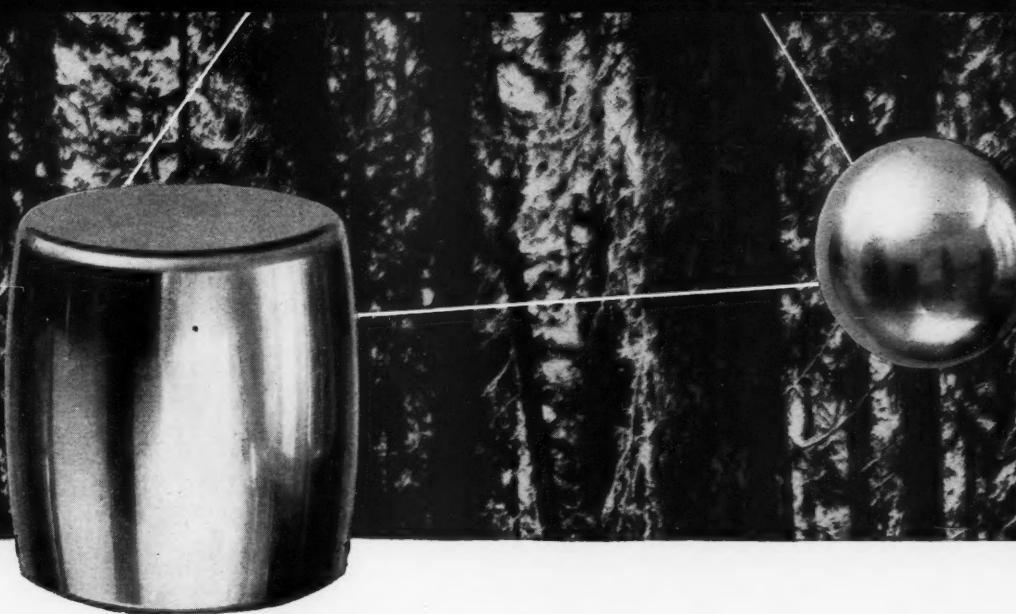
NEOPRENE
HYPALON*
VITON*
ADIPRENE*

*Registered trademark of E.I. du Pont de Nemours & Co. (Inc.)

For further information mark No. 124 on Readers' Service Card



Skilled answer TO A SPECIAL PROBLEM



Paper Manufacturers in all parts of Canada are turning to Fischer bearings—and for good reason! Fischer, backed by over 75 years of experience, supplies bearings made with studied knowledge of the tough problems that have to be licked in a tough industry. Paper processing equipment can chew up bearings faster than accounting can estimate accurate downtime cost. Why not call on Fischer to help cut your operating expense?

SINCE 1883

From couch to calender rolls, Fischer has a job-researched bearing for every need.

FISCHER BEARINGS MANUFACTURING LTD.

Stratford

Canada



IBUTORS ST. JOHN, N.B. • QUEBEC CITY • THREE RIVERS • MONTREAL • OTTAWA • TORONTO
LOCATED IN SUDBURY • TIMMINS • WINNIPEG • EDMONTON • CALGARY • VANCOUVER

ENGINEERING OFFICES IN
TORONTO, MONTREAL

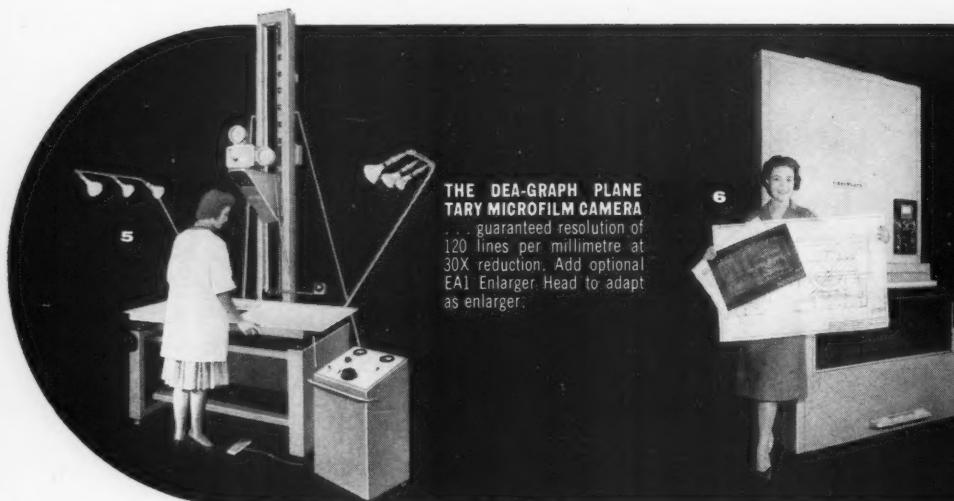
BRUNING

provides Canada's widest choice in drawing reproduction equipment

In engineering and architectural draughting work, the use of the diazotype whiteprinting process is steadily increasing to produce easy-to-read, exact facsimiles (positives not negatives) of originals or tracings and because it reduces draughting time as well as reproduction costs. Bruning, recently joined with Paragon Revolute, now makes available the widest range of moist or dry whiteprinting machines and materials.



COPYFLEX MODEL 320 . . . a diazo printer designed to handle big tracings, up to 42" wide, with a small budget. Takes limited space.



THE REVOLUTE MINIATURIZATION CAMERA
reduced-size transparency made directly from original drawings for immediate reproduction in blue print or diazo-type equipment.

In the field of miniaturization Bruning has a complete selection of microfilming equipment as well as continuous reducing printers and processors for retrievable miniaturization.

In whiteprinting or miniaturization Bruning can suit your requirements completely . . . in prices, sizes and capacities.

Now you don't have to make capital expenditures to make capital improvements! Use Bruning's low-monthly-payment plan to lease-purchase the equipment you need for increased efficiency.

For full information fill in and send coupon.

Charles Bruning Co., Ltd.
37 Advance Road
Toronto, Ont.

Gentlemen:

Please send me information on Items checked: 1 2 3 4 5 6
7 8 9 10 11

NAME.....

TITLE.....

COMPANY.....

STREET.....

CITY.....



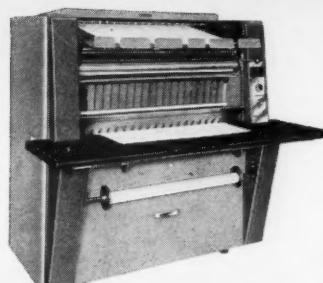
MAT
Bruning provides everything necessary for draughting for diazotype whiteprint miniaturization.

LOW COST DI

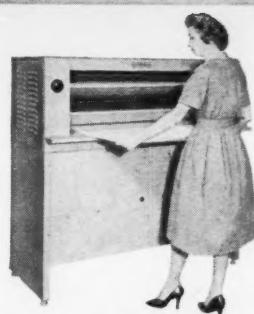
For further information mark No. 110 on Readers' Service Card



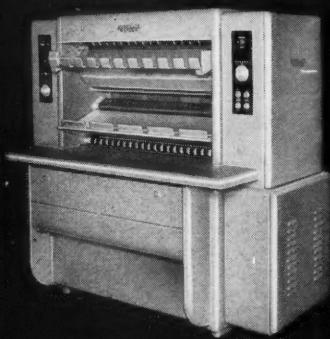
COPYFLEX MODEL 300 . . . a compact, self-contained low-cost tabletop machine. Printing width, 30".



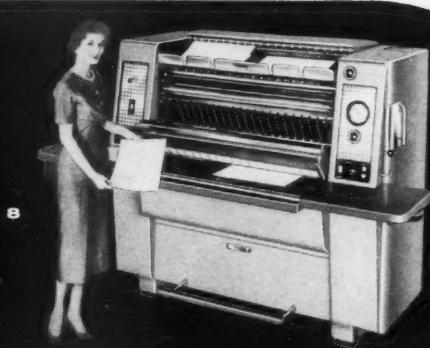
COPYFLEX MODEL 430 . . . a low cost medium volume whiteprinter. It will handle standard 42" rolls or multiple sheet feedings.



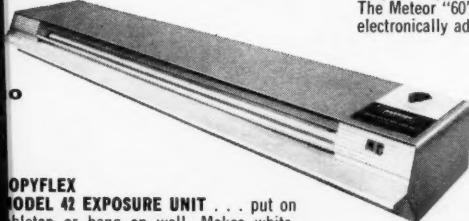
THE REVOLUTE ROCKETTE . . . new dry diazo machine with a simple one-knob control and stainless steel perforated developing rollers.



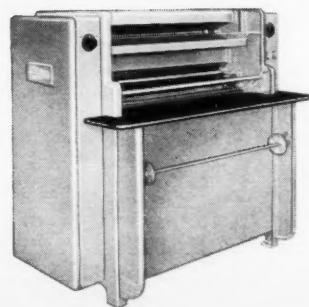
REVOLUTE STAR . . . 54", 42" and 24" models provide up to 75 feet per minute. Designed to stand heavy use with minimum maintenance.



COPYFLEX MODEL 675 . . . gives high volume reproduction. Low, streamlined and super-powered for high-quality, economical printing.



COPYFLEX MODEL 42 EXPOSURE UNIT . . . put on tabletop or hang on wall. Makes white-printing available to everyone. Lightweight, yet prints up to 42" wide.



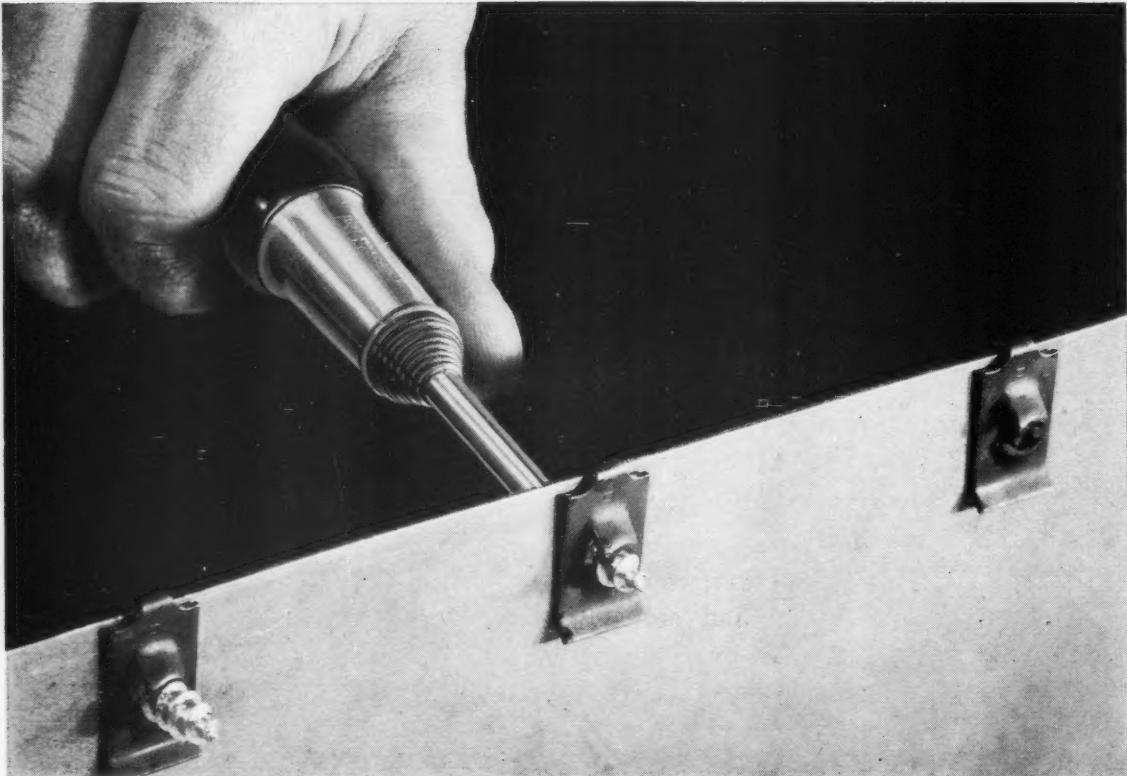
THE REVOLUTE METEOR "60" . . . simple to operate, easy to maintain. The Meteor "60" is quiet in operation, with electronically adjusted speed.

BRUNING

COPYING AT ITS BEST!

CHARLES BRUNING CO., LTD. 37 ADVANCE ROAD, TORONTO, ONT.

Now, more than ever, it's time to cut costs



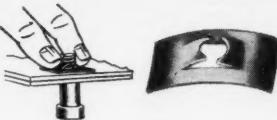
Speed Nut Fasteners give savings from 30% to 75% or more over other methods

Competition for your share of the market is increasing from home and abroad. By reducing your product assembly time and lowering fastener costs you will improve your profit picture and make your product more competitive.

Dominion Fasteners Speed Nuts *will* reduce assembly time; *will* lower fastener costs; *will* improve your profit picture. Investigate the Speed Nut method of fastening.

Speed Nuts can save time and money in your assembly. There are over 8,000 types and sizes available

FLAT TYPES—one piece, self-locking. Replace threaded nuts, lock washers and spanner washers.



EXPANSION TYPES—for fast assembly in blind locations where there is access to one side only. Snap by hand into square holes.



DART-TYPE CLIPS—dart portion compresses as it is snapped into hole, springs back to retain itself in place, or to lock panels together.



SPEED GRIPS—snap easily into bolt-receiving position without use of special equipment or skills; provide floating alignment.



PUSH-ONS—zip over unthreaded die-cast or plastic studs, rivets, nails, tubing or wire to lock parts securely.



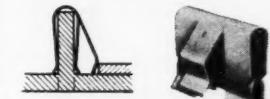
CABLE CLIPS—snap in place by hand and hold themselves in position by "heel and toe." Easily removed for servicing.



TUBULAR CLIPS—for use with unthreaded studs or rivets on attachments where there is access to front side only.



"U" AND "S" CLIPS—for attaching metal, plastic or wood panels with a spring cushion. Eliminate holes in panels.



"J" TYPES—snap over edge of panels or into centre-hole locations. Hold themselves in place for blind assembly.



COMPRESSION RINGS AND "C" CLIPS—for attaching plastic knob-to-shaft assemblies. Faster permanent assembly is assured.



"U" TYPES—perform same function as "J" types, used where full bearing on lower leg of the Speed Nut is required.



TUNING FASTENERS—for better, faster mounting of radio coil forms. Hold core in position and provide tension on adjustment screw.



Dominion Fasteners FASTENING ANALYSIS SERVICE

Make us prove to you that Speed Nuts will cut your production costs. Our skilled engineers will take one of your finished units, disassemble it, study it piece by piece, and reassemble it using Speed Nuts where applicable. Then, in a detailed report, we will give you an accounting of the time and cost savings

affected by the use of Speed Nuts. If there is not a fastener already produced that is suitable for your particular application, we will design one that is.

This fastening analysis service is free—take advantage of it today.

Write for full particulars:
DOMINION FASTENERS LIMITED
a Gen. A. Tinnerman corporation
 Hamilton, Ontario
 Sales Branches: Toronto, Montreal

DOMINION FASTENERS

Exclusive TINNERMAN Canadian Licencee

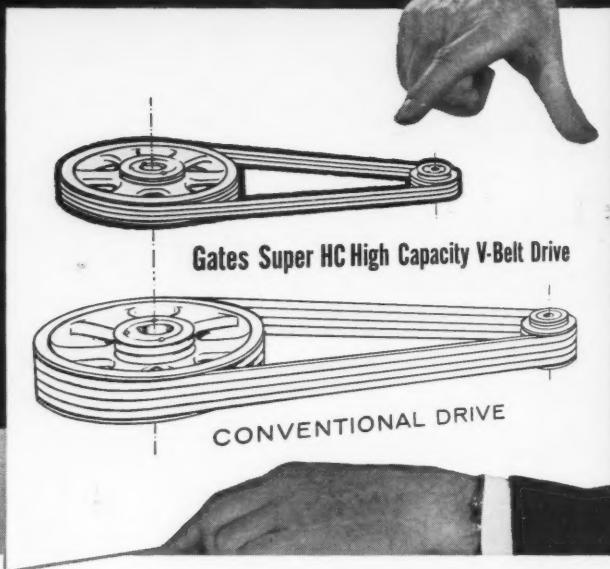
Speed Nuts

33-608

For further information mark No. 120 on Readers' Service Card

DESIGN ENGINEERING FEBRUARY 1961

*Need a better drive
for a machine?*



Ask your Gates Representative to show how Super HC Drives save space, weight, money

If the sheaves and V-belts of a machine need replacing or if a chain, gear or other type of drive isn't giving you good performance, your local Gates Representative will be glad to help you. He can show you how to take full advantage of the many opportunities offered by Gates Super HC High Capacity Drives.

Ask him to design a drive for your machine two ways: A conventional V-belt drive and a new Gates Super HC High Capacity V-Belt Drive. A quick comparison will show you many of the important savings provided by the new Gates drive.

Industrial plants throughout Canada have standardized upon the Gates Super HC V-Belt Drive—industry's first and most advanced high capacity drive. It is your best assurance that your power transmission unit will not soon become obsolete.

Your local Gates Representative is an experienced, fully-qualified drive design expert. Contact him for drive design help.

Gates Rubber of Canada Ltd., Brantford, Ontario

Gates Super HC Drives give you these benefits:

Handles up to 3 times more hp than conventional V-belts in same space.

Saves up to 50% in drive space and reduces drive weight 20% and more.

Cuts drive costs as much as 20%.

Reduces bearing load, increasing bearing life.

Guards can be smaller, lighter weight.

Belt speed up to 6000 ft/min possible without dynamic balancing.

Less costly, higher speed motors can often be used.



Exclusive design features include: precisely engineered arched top, concave sidewalls, Flex-Weave cover, super strength tensile construction.



World's largest
maker of V-Belts

Gates Super HC V-Belt Drives

For further information mark No. 128 on Readers' Service Card

WHERE SAFETY AND RELIABILITY ARE ESSENTIAL . . .



FOR MORE INFORMATION

about Teflon-lined Unibal spherical bearings and the new 6-page bulletin including catalog listings of stock sizes available, write to:

Send for bulletin of complete list of sizes and ratings

RJM BEARINGS CANADA LTD.

QUEBEC CITY MONTREAL WINNIPEG THREE RIVERS
755 Blvd. des Capucins 1006 Mountain St. 1302 Notre Dame Ave. 373 St. Georges St.
TORONTO VANCOUVER LONDON, ONT. HAMILTON SEPT-ILES, QUE.
33 & 50 Edward St. 1066 Seymour St. 1024 Oxford St. East 130 Ferguson Ave. N. 383 Joliette St.

FACTORY REPRESENTATIVES AND DISTRIBUTORS FOR CANADA

For further information mark No. 130 on Readers' Service Card

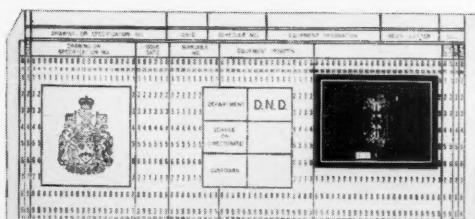
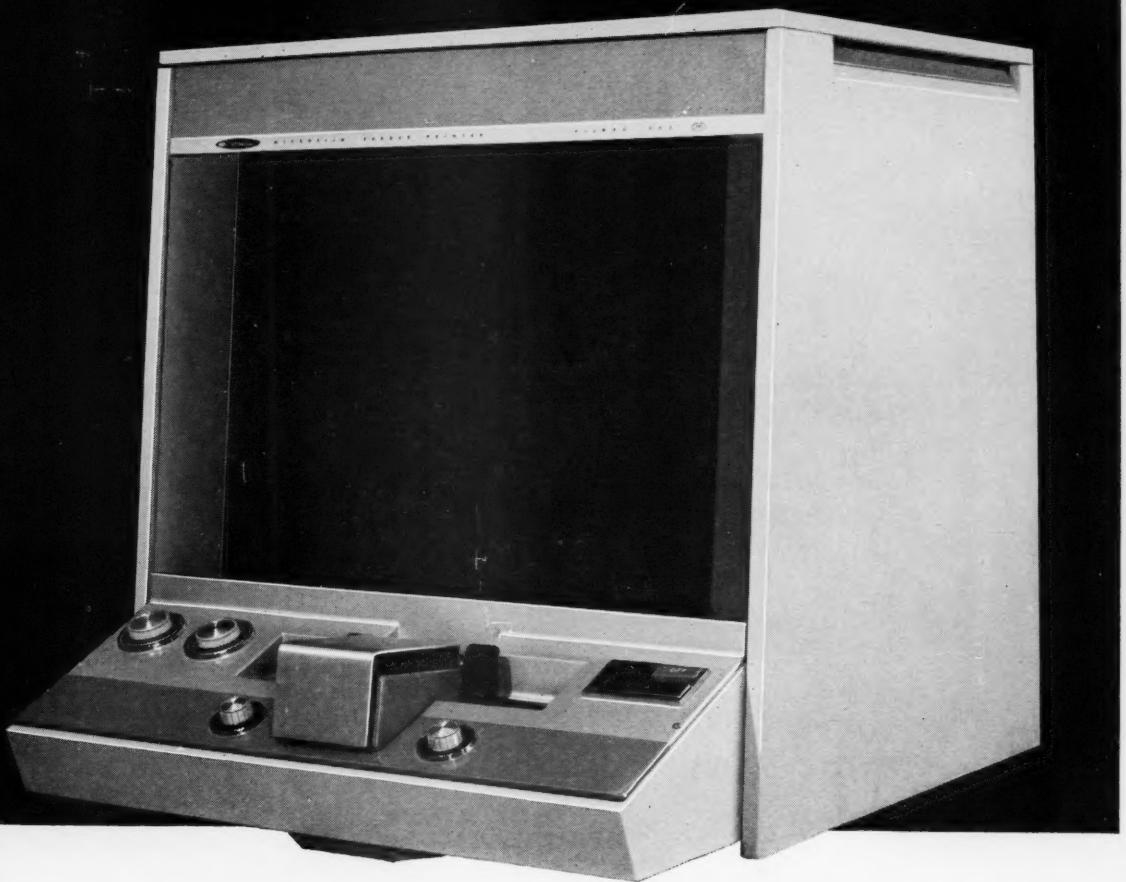
THE ONE
SIMPLE ANSWER
TO THE PROBLEM OF
TIME CONSUMING
SPACE TAKING
COSTLY
ENGINEERING PAPERWORK

MICROFILM

**LET US PROVE HOW A THERMO-FAX BRAND "FILMAC 200" READER-PRINTER
CAN STREAMLINE YOUR WHOLE REPRODUCTION SERVICE DEPARTMENT**

Lost in a maze of paperwork? Drawings mislaid or torn? Prints piling high on the floor? Let microfilm and the THERMO-FAX* "Filmac 200" Reader-Printer clear away this confusion and show immediate savings in manhours, materials and reproduction costs. The "Filmac 200" with "Filmsort"** Aperture Cards saves wear and tear on tracings; allows more vault space; makes reduced size prints as usable as the originals. Makes 18" x 24" copies in seconds at the touch of a button. What more could you ask? There's more! Microfilm makes distribution of drawings faster and less costly . . . never leaves engineers waiting at the counter . . . allows you to service every request when you get it. Investigate the "Filmac 200" Reader-Printer's low cost and fast, simple operation. We'll prove how it makes engineering drawing reference systems completely practical . . . at less cost. Mail the coupon now for full information.

*T.M. Reg'd.



This is a "Filmsort" Aperture Card. It is so accessible that in 6 to 12 seconds you can begin to use the facts stored on it. In another 20 seconds you can have a copy. Nothing leaves the files; nothing needs re-filing! With the "Filmsort" Aperture Card system you standardize the size of your drawings; locate information mechanically or manually; and originals stay in the file!

Mail coupon at right for your free copy of the new 36-page illustrated book, "How to cut industrial paperwork costs."

MINNESOTA MINING AND MANUFACTURING OF CANADA LIMITED,
BOX 757, LONDON, CANADA

Please send me complete information on microfilm systems along with the book, "How to cut industrial paperwork costs."



NAME _____

TITLE _____

COMPANY _____

ADDRESS _____

CITY _____ PROV. _____

102305RP

MINNESOTA MINING AND MANUFACTURING OF CANADA LIMITED

... where research is the key to tomorrow

For further information mark No. 144 on Readers' Service Card

YOUR BEST WORK REQUIRES CLEARPRINT

CLEARPRINT

Tracing Papers have served the Engineering and Architectural profession since 1933, and the oldest tracings still serve our many friends today, as they have served for over 27 years. Clearprint Papers are watermarked for your protection.

UNIFORMITY

The *Unchanging Character* of CLEARPRINT Papers includes an ideal Ink and Pencil Surface—Permanent Transparency—Outstanding Erasing as well as Handling—Reproduction and Lasting Qualities. To the above we have added—Clearprint does not discolor with age.

ERASING QUALITIES OF INK AND 2H PENCIL LINES

Drawn and redrawn—in the same areas—prove CLEARPRINT'S unequalled erasing strength. Please hold our *erased samples* to the light and be convinced.

PRINTING - HANDLING - AND LASTING QUALITIES

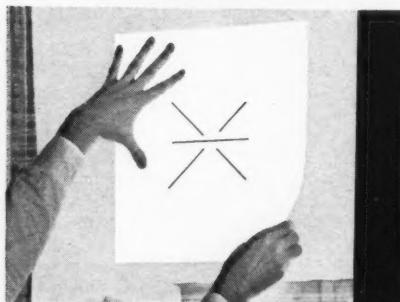
The Files of our many friends prove that CLEARPRINT originals are not subject to cracks and creases—they yield copies of fine definition.

CLEARPRINT'S VALUE TO YOU

The small amount supposedly saved by buying a cheaper paper is surely of minor significance when compared to the value of the drawings involved.

WE RECOMMEND

No. 1015 for transparency • No. 1000H for regular tracings • No. 1020 and 1025 for replacing cloth. Please ask for erased samples.



"FADE-OUT" PAPER
TECHNICAL PAPER

FORMS - CHARTS - GRAPHS

"PRE-PRINT" PAPER

THERE IS NO SUBSTITUTE

Clearprint is Watermarked For Your Protection

CLEARPRINT PAPER CO.

1482 - 67th St., Emeryville, Calif.

DE-1660

Send me Clearprint Fade-Out samples, with prices, for the following uses: _____

Name _____

Firm _____

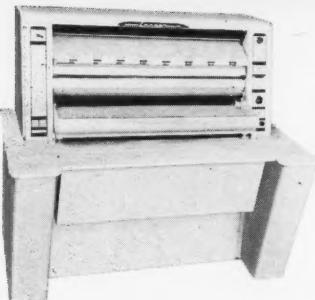
Address _____

City _____ Zone _____ Prov. _____

16 C

For further information mark No. 114 on Readers' Service Card

EVERYTHING FOR THE DRAFTSMAN, ENGINEER & INDUSTRY



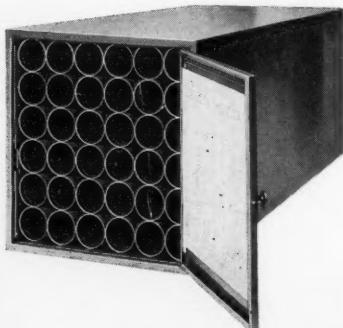
COPYMATION "LANCER"

High Speed — Fully Automatic. Preferred by reproduction Specialists for high quality, High Volume Whiteprinting. Up to 75' per minute at 100 watts per inch. Lease-Purchase Plan Available.



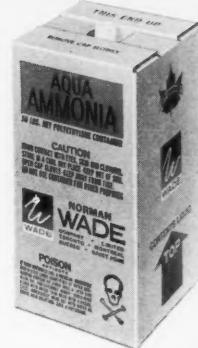
COPYMATION "DART"

Moist process all-purpose Whiteprinter. Brings cost-saving automation for systems requiring inexpensive copies. Available in 2 widths, 13" or 18", speeds up to 27' per minute. Lease-Purchase Plan Available.



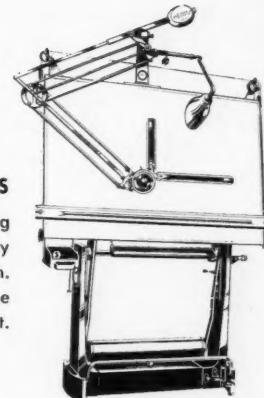
STACOR "STAKTUBE"

Efficient, low cost filing for tracings, prints, etc. Available in 32 different lengths and capacities. May be stacked several units high. This is the answer to safe, economical filing problems.



AQUA AMMONIA

New, lightweight plastic container—easy to handle. Low, low deposit on returnable container. Holds 50 lbs. of ammonia. Siphon head supplied free.



"UNIC" DRAFTING TABLES

The finest counterbalanced Drafting tables available. Perfectly rigid, yet adjustable to the touch. As modern as tomorrow — The ultimate in Drafting equipment.

**DI-LINE DIRECT PROCESS PAPERS, CLEARPRINT TRACING PAPERS,
CRONAFLEX DRAFTING & REPRODUCTION FILMS, DRAFTING SUPPLIES.**



NORMAN WADE COMPANY LTD.

TORONTO

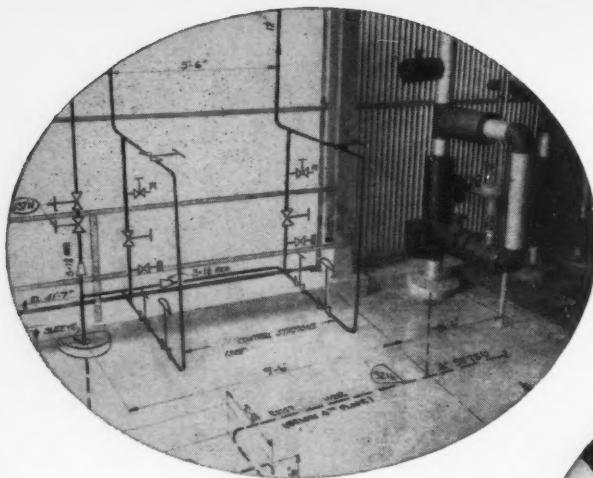
MONTREAL

SAINT JOHN

QUEBEC CITY

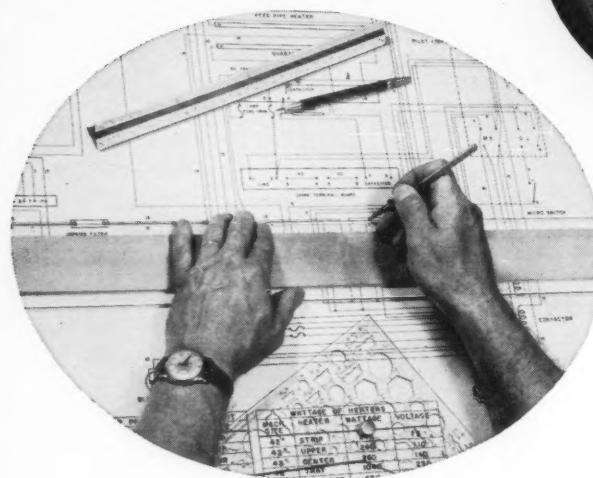
HALIFAX

CRONAFLEX*: best engineering films you can use



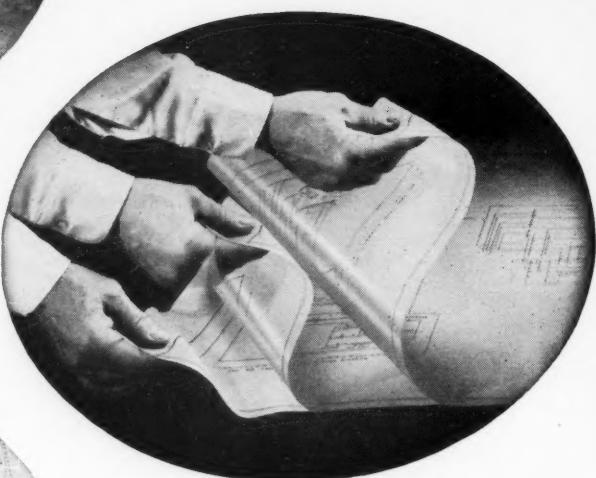
CRONAFLEX: Durability of CRONAR* base

CRONAFLEX copies are free of kinks and tears. Its rugged and flexible base adds years of life to your drawings.



CRONAFLEX: Photographic versatility

CRONAFLEX plus photography plus drafting equals the best combination for photo-drafting techniques.



CRONAFLEX: Superb drafting surface

Matted on both sides, CRONAFLEX accepts pencil and ink, erases easily without ghosting or affecting the surface.



**Better Things for Better Living
...through Chemistry**



*Registered trademark of E.I. du Pont de Nemours & Co. (Inc.)

CRONAFLEX Engineering Reproduction Films are now being used to make outstanding reproductions of engineering drawings in shops everywhere. Shown here are three major reasons that help explain its success. There are more.

ALL CRONAFLEX films are on rugged CRONAR* polyester base. This means they are dimensionally stable . . . so stable that many companies use them for exacting template work. CRONAFLEX intermediates provide faster print-through speeds and better resolution of detail because of the optical clarity of the base.

CRONAFLEX films are now available in four types: (1) Direct Positive Film; (2) Contact Film; (3) Projection Film; (4) CRONAFLEX Drafting Films. It's the most complete versatile line of engineering reproduction films you can use. For more information, contact your DuPont Technical Representative, or write: DuPont of Canada Ltd. Photo Products, 85 Eglinton Ave. East, Toronto 12, Ontario.

For further information mark No. 123 on Readers' Service Card

Place it!
Thread it!
Clinch it!



TY-RAP Method— 6 jobs faster than cord, tape and clamps!

Ty-Rap is the new nylon cable tie that cuts 50% off your tying costs, at every stage of the operation. Inventory is reduced, for a single Ty-Rap replaces up to 27 different clamp sizes. Mastery time is cut by 75%, and all different cord weights are eliminated.

Ty-Rap cable ties have holding strengths of 25, 60 and 125 lbs. Fully adjustable, they'll never vibrate loose, slip, or relax their grip. Case histories have shown savings of as high as \$32,000 per year over string-tying procedures.

For a personal sample of 10 color-coded Ty-Raps, a catalogue sheet and installation instructions, fill in the attached coupon. It's the first step to cutting your cable-tying costs. Mail it today!

THOMAS & BETTS LIMITED



751 Victoria Square • Montreal, Quebec

Sales Offices and Warehouses:

Saint John, N.B. • Toronto • Winnipeg •
Saskatoon • Calgary • Edmonton • Vancouver

ADEQUATE WIRING IS EVERYBODY'S BUSINESS

For further information mark No. 163 on Readers' Service Card

THOMAS & BETTS LTD., Dept. DE,

751 Victoria Square, Montreal, Que.

Please send me Free 10 Ty-Rap samples, plus a catalogue and instruction sheet by return mail.

NAME

ADDRESS

.....

CITY PROV.

Eight good reasons why you should buy THE BELLOW'S AIR MOTOR

**-the air cylinder with
the built-in valve**



MADE IN
CANADA

- no extra valves—all operating controls are built-in
- choice of valve types: low voltage, JIC, pilot-actuated, mechanically actuated
- responds to starting impulse instantly—no lag, no stutter
- fits well in tight quarters, on moving machine elements
- no cumbersome piping, requires only a single air connection
- available in five bore sizes: $1\frac{1}{4}$, $1\frac{3}{4}$, $2\frac{1}{2}$, $3\frac{3}{8}$, $4\frac{1}{2}$ "
- made in any stroke length
- over 150 skilled field engineers the world over to handle your fluid power requirements.

They all add up to:

LESS DESIGN TIME REQUIRED,
LESS COST TO INSTALL AND MAINTAIN

Write for this Booklet

"The Bellows Air Motor in
Original Equipment Design."
Write Dept. DE-261, Bellows-Valvair Ltd., Toronto
18, Ontario



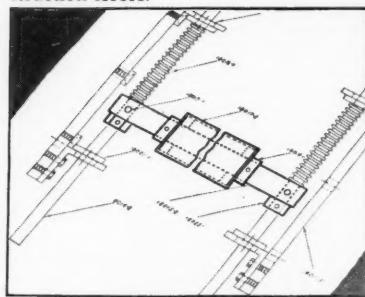
Bellows-Valvair, LTD.
14 Advance Road
Toronto 18, Ont.
SUBSIDIARY OF INTERNATIONAL BASIC ECONOMY CORPORATION (IBEC)

1221-B-1

For further information mark No. 107 on Readers' Service Card

Ever Want Prints Emphasizing Parts of a Drawing?

Engineers, architects and many other types of technical people often want prints that separate key parts of a drawing from the rest of it, and some weird and costly techniques have been used. This is understandable because the cost of *not* getting good separation or emphasis can also be shocking. Take the case of a large West Coast engineering organization constantly involved in plant construction. They used sepia prints of floor plans to lay out the electrical work. But the lack of contrast between the plumbing shown in the sepias and the electrical layouts added required hours of careful checking and frequent revisions, even caused some expensive construction errors.



Diazo print from special-blue image intermediate produces a sharp contrast between the parts to be emphasized and those to be subdued.

That's all ancient history now! Two of Dietzgen's numerous modern drafting-printmaking aids have turned this tough old chore into a picnic. They are new drafting media (one a polyester film and

DISTRIBUTORS

INSTRUMENTS (1951) LIMITED

14 Adelaide St. West	Toronto, Ont.
645 Wellington St.	Ottawa, Ont.
4646 Decarie Blvd.	Montreal, Quebec
1747 Hamilton Street	Regina, Sask.

W. J. DICK & COMPANY

379 Cumberland Avenue Winnipeg, Man.
LEY'S REPRODUCTIONS LTD.
631 8th Avenue South West Calgary, Alta.
10514 Jasper Avenue Edmonton, Alta.
2415 13th Avenue Banff, Alta.

RILEY'S OF VANCOUVER LIMITED

620 Burrard Street Vancouver, B.C.
Note: Exclusive distributors of Reproduction
Materials in B.C. only.

SOLVED: A COSTLY PROBLEM OF COMBINING DRAWINGS AND GRAPHS



Drafting time costing as much as \$40 was used to draw a single grid...and draftsmen resented the tedious assignment.

A large manufacturer of automotive parts decided to plot their graphs directly on the drawings in order to end the nuisance of their being separated in

the other a vellum) diazo sensitized to produce a special blue image. The reproduction of your basic drawing on either of these media is bold and clear so drafting additions can be made without confusion or error. But when you make prints from the completed intermediate, the basic part in the special blue prints faintly (clearly visible but subdued) . . . while the added drafting, even in pencil, prints strong and bold. The results are perfect, easily and quickly obtained, delightfully inexpensive.

handling, filing, plant interchange, etc. But this created many new problems. Tracing or drawing the grids in position proved costly, as much as \$40 each in drafting time. They were rarely accurate and never uniform in character. The lines often smudged and usually reproduced poorly. The work created a morale problem because draftsmen resented the tedious assignment.

One of Dietzgen's modern drafting-printmaking aids furnished a perfect answer! It is a light-weight drafting film which is adhesive-backed and furnished printed with a stock grid. It is simply mounted in place and the grids are sharp, clean, clear and uniform, so much more accurate that fewer plotting points are needed to develop the graphs. Reproductions were so noticeably better as prints moved through other departments and associated plants that the change was investigated and quickly adopted. Much needed drafting time and capacity is saved and the reduction in costs amounts to many thousands of dollars a year.

**ARCHITECTURAL and ENGINEERING
SUPPLIES in B.C.**

WILLSON STATIONERY CO. LTD.

CLARKE & STUART CO. LTD.

550 Seymour St. Vancouver, B.C.

DIETZGEN OF CANADA LIMITED

5304 5th St. S.E. **Calgary, Alta.**

DIETZGEN

**EVERYTHING FOR DRAFTING
SURVEYING & PRINTMAKING**

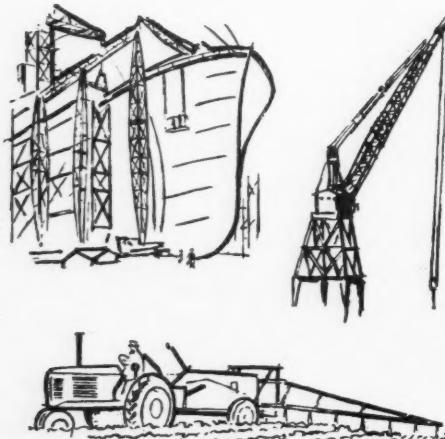
"SPECIAL" STEELS FOR INDUSTRY...

STELCOLOY*

STRENGLITE*

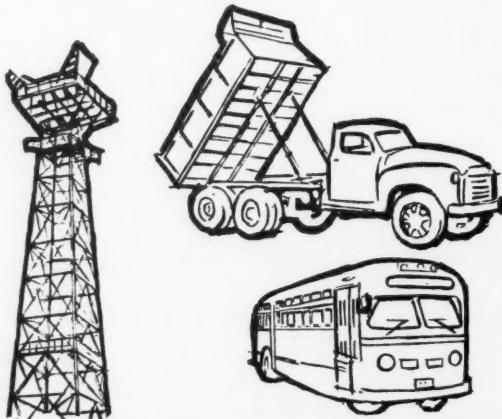
★ STELCOLOY—*High-Tensile
Low Alloy!*

- High strength-to-weight ratio.
- High impact properties at low service temperatures.
- Twice the atmospheric corrosion resistance of copper-bearing steel.
- Four to six times the resistance of mild steel to atmospheric corrosion.
- Can be readily cold formed.
- Good welding properties.
- Provides excellent adherence for paint.



★ STRENGLITE—*Strong Yet Light!*

- Saves weight without sacrificing strength.
- Equals copper-bearing steel in corrosion resistance.
- Highly resistant to abrasion.
- Suited to bolted or riveted assemblies.
- Can be successfully welded with mild steel electrodes.
- May be formed cold up to $\frac{1}{2}$ " in thickness.



Both "STELCOLOY" and "STRENGLITE" are available in plate, hot and cold rolled sheets, coils and slit strip, bars, angles, and hot rolled rods.

FOR DETAILED INFORMATION APPLY TO ANY
STELCO SALES OFFICE



THE STEEL COMPANY OF CANADA, LIMITED

Executive Offices: Hamilton and Montreal

Sales Offices: Halifax, Saint John, Montreal, Ottawa, Toronto, Hamilton, London, Windsor, Sudbury, Winnipeg, Edmonton, Calgary, Vancouver. J. C. Pratt & Co. Limited, St. John's, Newfoundland

For further information mark No. 159 on Readers' Service Card

LOOK!

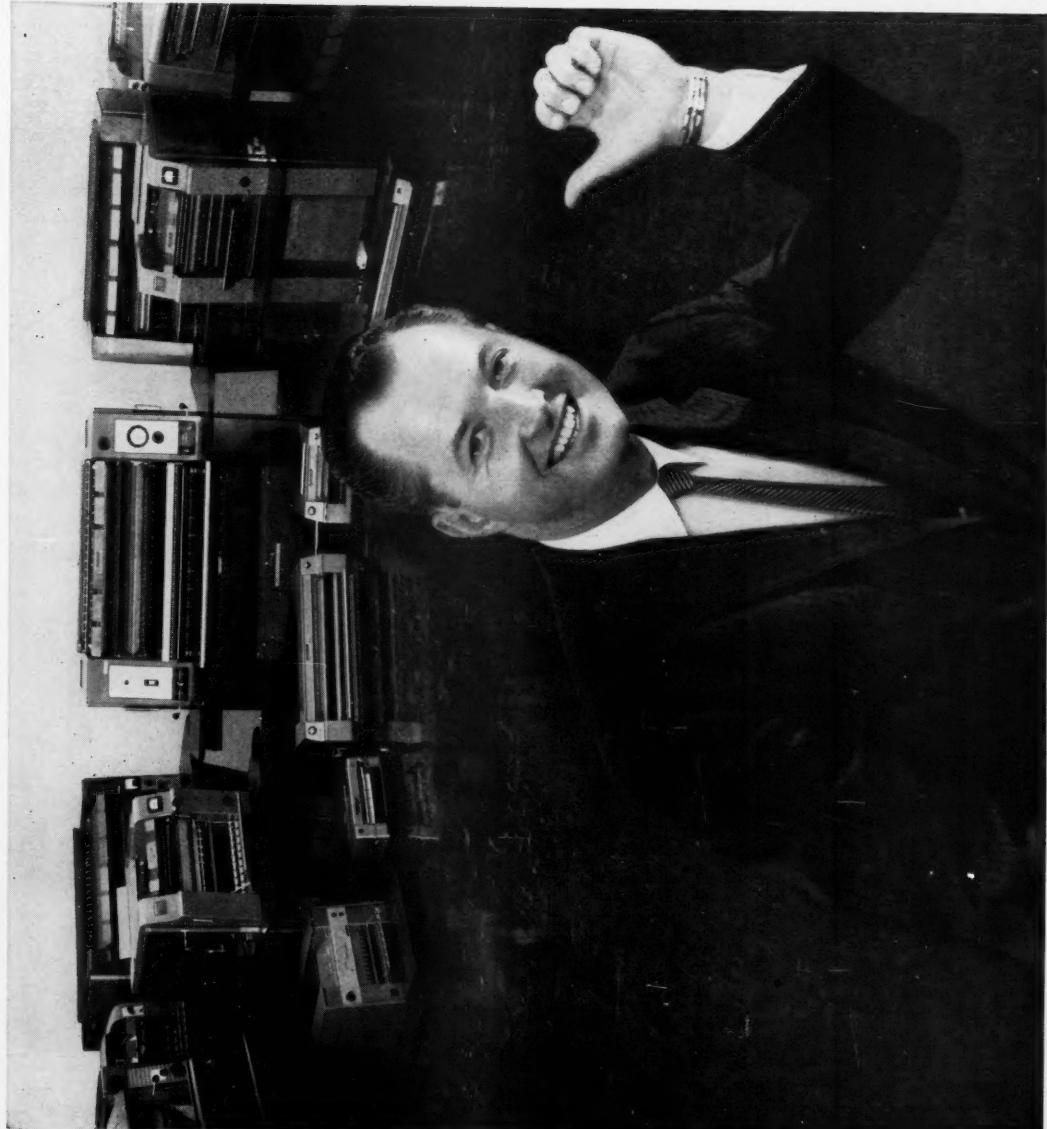
14 great new copy machines in the Ozalid®-Ozafax line!

Each one styled, sized, and priced to give you maximum efficiency for every office or plant need.

Got a preference in diazo reproduction equipment? Ozalid dry or Ozafax semi-dry (sometimes known as "moist")—take your choice from 14 brand-new models, rarin' to work for you.

In seconds, these machines make office and engineering reproductions you can hardly tell from originals. Save you time, work, money. Eliminate office copying errors, retyping, proofreading, double-checking. Increase print output, reduce reproduction costs. Paper cost? As little as 1¢ for a letter-sized copy.

Find out about the complete Ozalid-Ozafax line. Talk to an Ozalid salesman or write: Ozalid, Johnson City, N. Y. In Canada, Hughes-Owens Ltd., Montreal.



For further information mark No. 131 on Readers' Service Card

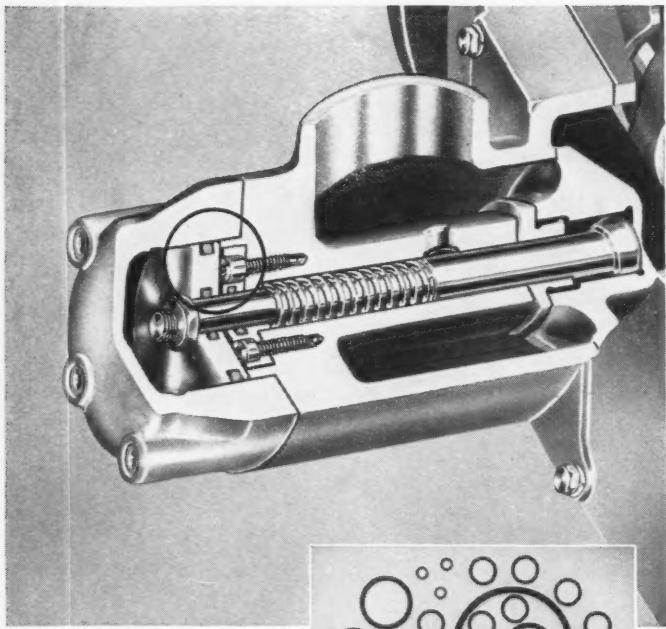
DESIGN ENGINEERING FEBRUARY 1961

Ozalid for '61—boldest new look in the business!

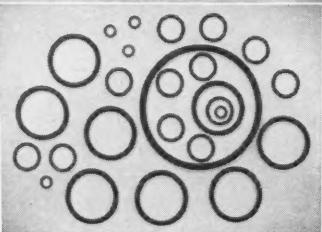


ENGINEERED TEFLON PRODUCTS

for Hydraulic, Pneumatic
Service



Joy Manufacturing Company specifies Garlock TEF-COTE "O" Rings (lower right) for tight, frictionless sealing on inlet valve of rotary air compressor (top).



Garlock TEF-COTE "O" Rings stop air leakage—without slip stick and adhesion—on Joy portable compressors.

During exhaustive tests of 500,000 cycles at a 1" stroke, TEF-COTE "O" Rings proved completely satisfactory for operation on Joy two-stage rotary portable air compressors supplied to the Corps of Engineers. As plunger seals on the inlet valve, the rings seal pressures to 40 p.s.i., temperatures from +90°F to +120°F on a rotary shaft moving at 30 cycles per hour.

To minimize cylinder breakaway friction, chattering or freezing, do as the Joy Manufacturing Company has done. Investigate the possibility of Garlock TEF-COTE "O" Rings on hydraulic and pneumatic valves and cylinders, and valve stems. TEF-COTE "O" Rings—solid rubber, coated with Teflon†—offer a fine combination of low breakaway and low running friction. Garlock also offers "O" Ring Packings of solid Teflon for exceptional antifriction sealing at temperatures from -100°F to +500°F. Where unidirectional pressures are encountered, specify Garlock slotted "O" rings of Teflon—they are designed for simple installation into standard AN grooves. **When you design fluid power equipment,** consider using Garlock "O" Ring Packings. They are available in many sizes and materials—nitrile, butyl, silicone, and Viton† rubber and Teflon to meet your needs. For application recommendations, consult your local Garlock representative. He is backed by years and years of experience in the design, manufacture and application of packings and seals of all types. Call him at the nearest of the 26 Garlock sales offices and warehouses throughout the U.S. and Canada. Or, write for Catalogs AD-148 and AD-157. Garlock of Canada Ltd.

GARLOCK

General Offices: Toronto, Ont.

Branch Offices: Hamilton, Montreal, Winnipeg, Edmonton, Vancouver

Plastics Div.: United States Gasket Company

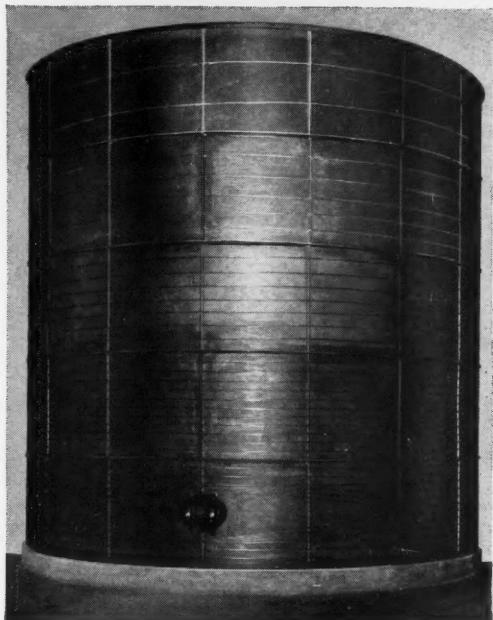
Order from the Garlock 2,000 . . . two thousand different styles of Packings, Gaskets, Seals, Molded and Extruded Rubber, Plastic Products.

*DuPont Trademark

For further information mark No. 127 on Readers' Service Card

VIBRIN

*molds better products
more economically!*



VIBRIN Waiting Room for CHEMICALS AND LIQUID FOODS

This 14,500-gallon Kabe-O-Rap storage tank is built of VIBRIN (F-35) by Markham Reinforced Plastics Ltd., a division of Humphrey-Cosburn Plastics Ltd. VIBRIN's own great strength-to-weight ratio combines with this novel Kabe-O-Rap tank building technique to achieve the highest safety factor in the industry. And being VIBRIN, it solves the constant problem of storage with matchless economy.

Every day, VIBRIN is improving on metal, wood and other materials, in a multitude of products which include watercraft, aircraft,

locomotive parts, traffic signs, truck bodies, and bowling alley equipment and furnishings.

You'll like VIBRIN's wax-like obedience to pressure which makes it so easy to mold, and its uncompromising loyalty to shape.

Naugatuck technical representatives are at your service, and the facilities of our development laboratories are available to help you evaluate VIBRIN. Simply contact Naugatuck Chemicals at Elmira, Ont., or branches in Montreal, Toronto, Winnipeg or Vancouver.

VIBRIN IS DISTRIBUTED BY:

HALIFAX: PLASTICS MARITIMES LIMITED
MONTREAL: WALDOR ENTERPRISES LIMITED
TORONTO: QUEEN CITY DISTRIBUTORS

WINNIPEG: PARK-HANNESSON LIMITED
EDMONTON: PARK-HANNESSON LIMITED
VANCOUVER: FIBERPLAST PRODUCTS LIMITED



NAUGATUCK CHEMICALS

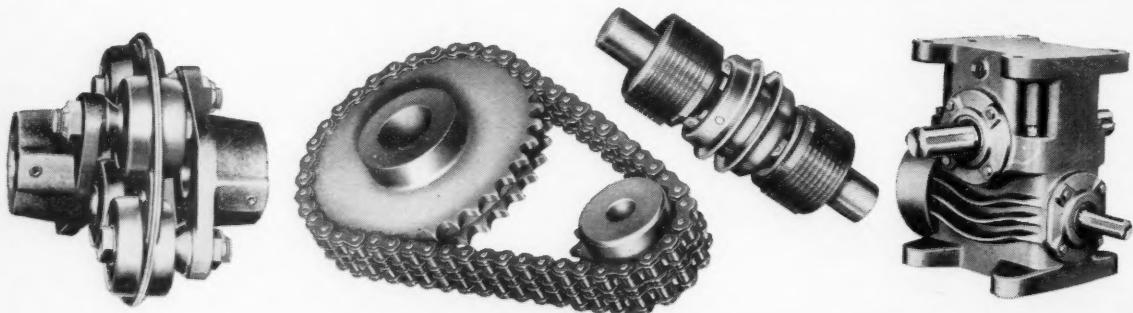
DIVISION OF DOMINION RUBBER COMPANY LIMITED

For further information mark No. 121 on Readers' Service Card



Morse has an answer to every industrial drive problem under the sun

Basic Drives, Speed Reducers, Couplings, Clutches—only Morse makes all four and only Morse stocks all four. For example, if your industrial drive problem involves basic drives such as roller chain, silent chain, and Hy-Vo® Drives, or "Timing"® belts, friction clutches, and couplings, too, look to Morse for the answer. You'll get impartial engineering help and immediate delivery.



As for quality, Morse products speak for themselves: Morse timing chain is specified as original equipment by every Canadian automobile manufacturer. Therefore, no matter what your industrial drive problem, your Morse distributor is the man to talk to. He's listed in the classified directory under Power Transmission. Or write: Morse Chain of Canada, Ltd., A Borg-Warner Industry.

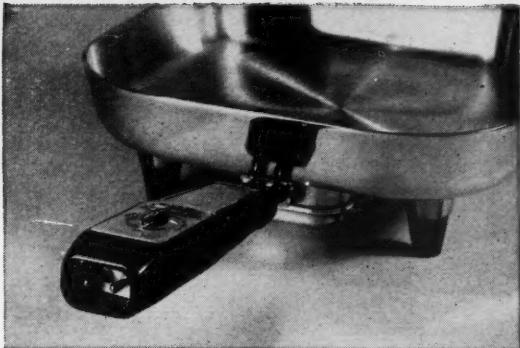


Factory: Simcoe, Ontario: GA 6-4960
Sales Offices: Toronto LE 6-7177; Montreal HU 8-1300

MORSE
A BORG-WARNER INDUSTRY



For further information mark No. 146 on Readers' Service Card



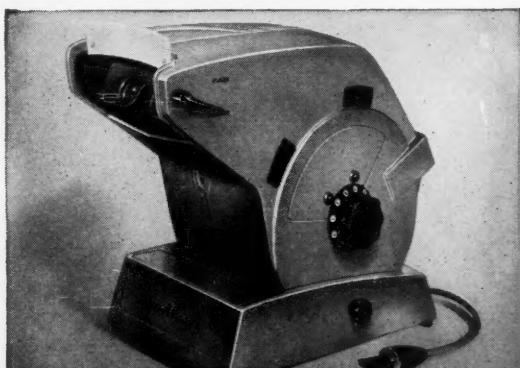
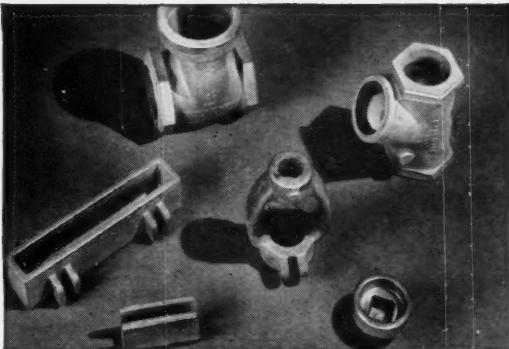
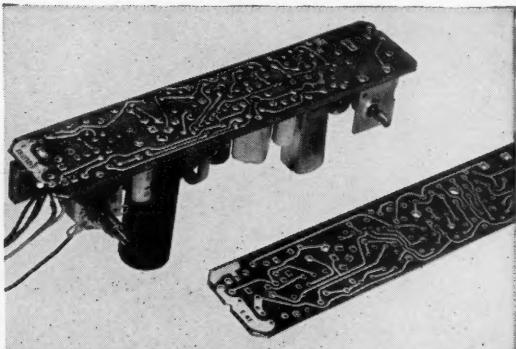
1 The handle of this automatic fry pan is molded of phenolic to:
(a) stay cool (b) fit small hands
(c) insulate inner wiring



2 In 18 years, it's been re-coated with phenolic paints:
(a) 2 times (b) 5 times
(c) 9 times

Can you pass this test on Phenolic Plastics?

(You'll profit by knowing them better)



5 This device to test vision has a molded phenolic case that:
(a) cuts weight 50% (b) needs 25% less tooling
(c) requires no coating

ANSWERS ... to design and production problems throughout industry are found in dependable BAKELITE phenolic plastics.

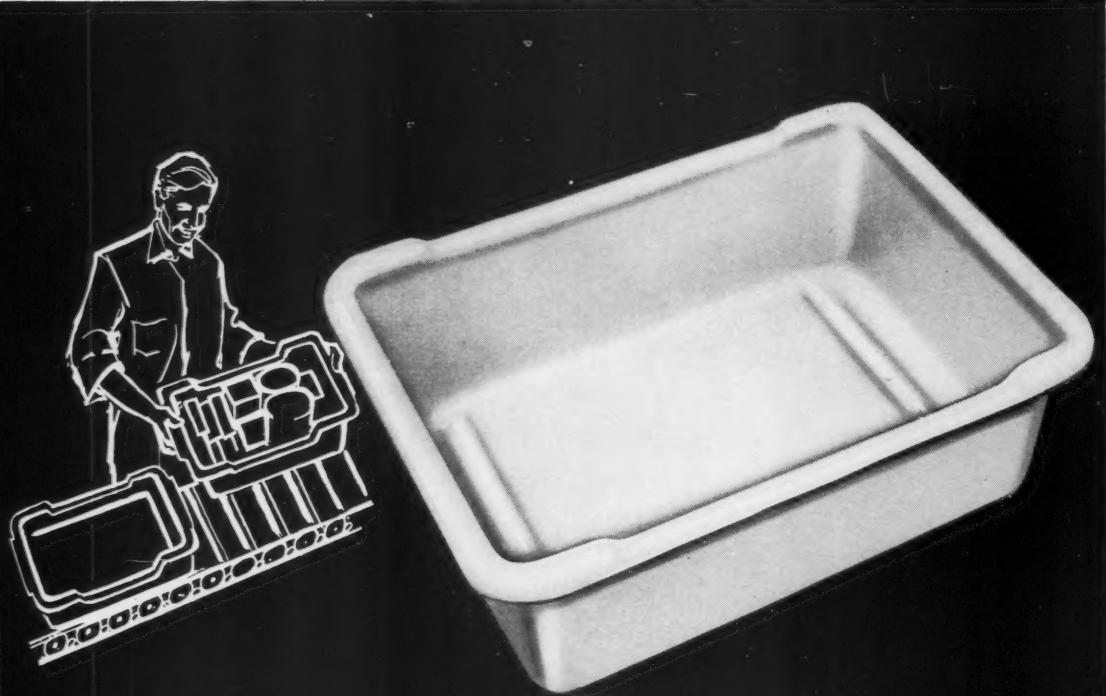
1. Check (a) and (c), and add durability.
2. (a) Twice – phenolic paints last 7 years on the San Francisco Bay Bridge.
3. (b) A laminate—machineable, chemically inert, and non-conductive.
4. (a) Lightweight shell molds that virtually eliminate machining.
5. Check (a), (b), and (c)—it saved all around.

If you have questions—about phenolics and their potential for your business—please ask us. Why not discuss the matter with a Bakelite Technical Representative? Just write or call any of our offices, or write Union Carbide Canada Limited, Bakelite Division, 123 Eglinton Ave. E., Toronto 12, Canada.

BAKELITE DIVISION

The logo for Union Carbide, featuring the company name in a bold, sans-serif font inside a dark, diamond-shaped border.

A GeMex APPLICATION



INDUSTRIAL TOTE BOXES

For greater
ECONOMY
AND
EFFICIENCY
IN
material handling
operations

Since the dawn of civilization, man has used baskets and boxes to tote and carry his many possessions.

Now at last, a new man-made material provides for a really efficient product.

The New GeMex Tote Boxes specially designed for easy carrying, solid stacking and nesting can increase the efficiency of your material handling operations.

Stronger, lighter, and requiring no maintenance, GeMex Tote Boxes are lower in cost, and yet are practically indestructible.

Descriptive literature and sample of the material are available on request . . .



G.M. PLASTIC CORPORATION
P.O. Box 548 GRANBY, P.Q. FRONTENAC 2-5457

For further information mark No. 129 on Readers' Service Card

Some Ideas



for your file of practical information on
drafting and reproduction from

KEUFFEL & ESSER CO.

Six years ago, K&E introduced the very first polyester-base drafting film—a special-purpose medium featuring extreme dimensional stability. Experience with that film indicated that a definite need also existed for a *general-purpose* drafting film, if one could be perfected. About two and a half years ago we succeeded, introducing HERCULENE® Drafting Film—the first polyester-base medium for general drafting to meet professional standards. Many recognized its value immediately, stocked up on HERCULENE, and have used it happily ever since. Others—a bit more “canny” about adopting a relatively untried medium—deferred decision, saying “see us in a year or so.” Still others—having tried one or more of the other films marketed immediately after HERCULENE—seemed permanently disenchanted with *all* film based media. What with the passage of time and much favorable ado about drafting films in general, we rather think that those once stung may now have adopted a more congenial attitude—so we address ourselves solely:

To fence-sitters everywhere...

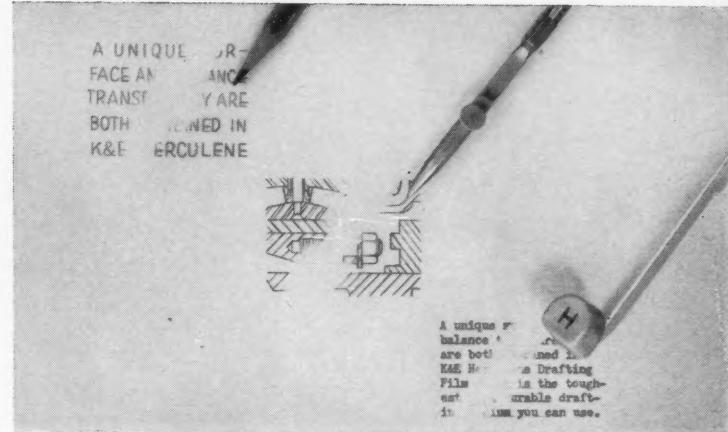
Just as we felt in '58, we feel today, that film has an important place in the drafting room. The only difference now is that experience has *proved* it so. Since 1958, the number of HERCULENE users has grown by leaps and bounds. All, we're happy to say, have found HERCULENE a welcome, efficient, and *much needed* addition to their stock of drafting media. It is these HERCULENE users who have written the record. Their many and rigorous tests, their months of experience, their numerous successes and continuing satisfaction are convincing evidence that HERCULENE is all we said it would be.

Why all the fuss about HERCULENE?...

HERCULENE combines practically all the qualities of a perfect drafting medium. An excellent product when introduced, it's even closer to perfection today. Working with major film users, K&E specialists have refined HERCULENE in many subtle ways since its introduction.

Unlike cloth or paper, HERCULENE is virtually indestructible. No matter how roughly or frequently a HERCULENE tracing is handled, it will never crack, wrinkle or fade. Absolutely waterproof, a HERCULENE drawing can never be permeated and ruined by moisture. Filed away, HERCULENE will last indefinitely. And HERCULENE has body, too, making it far easier to handle and file, and to keep flat on the drawing board.

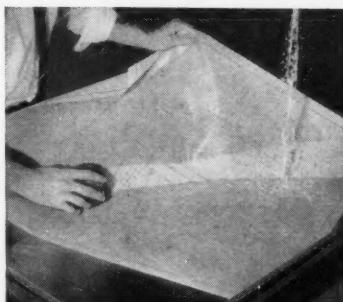
Most of the refinements made in HERCULENE since 1958 have concerned its engi-



neered drafting surface. HERCULENE's surface “take” for pencil, ink and typing is now better than ever. Erasability, of course, is excellent for all three. Contrast has been built up for sharper definition of line, too, yet all the transparency necessary for fast, clear reproductions has been maintained.

Two big bonuses, too...

A significant chapter in the HERCULENE story has been the development of a waterproof writing mate—the Duralar plastic pencil. Drawings made on HERCULENE with this waterproof pencil can actually be



washed in soap and water. Even gray, grimy “unreproducible” drawings can be washed spotless with this new technique. Many firms now use the HERCULENE/

Duralar team exclusively... and are realizing undreamt-of savings in costly re-draws. Some firms, of course, by virtue of smaller work volumes and “cleaner” or less frequent handling, will have little need for this new wash technique. Of particular interest here is another K&E exclusive recently introduced—the amazing Ruwe pencil. The Ruwe pencil will not withstand washing, but in every other respect, this new pencil is graphite-plus. Although of plastic composition, the Ruwe pencil has all the “fine” feel of graphite, erases well, and deposits a sharp, dense black line. The big bonus: Ruwe pencil lines are *virtually smudge-proof*. Rendered on HERCULENE's engineered drafting surface, they actually resist smudging better than graphite on regular paper!

We leave it to you...

The best test remains the one you make for yourself. We've just completed a new brochure, titled “A Report on the Growing Acceptance of Polyester Film.” In it is detailed most of what we have learned about HERCULENE and its use since 1958—including tests you can make to assess its every property. We'd like you to have a copy of this new brochure—plus a sample sheet of HERCULENE, a Duralar pencil, and a Ruwe pencil—for your own private testing. To get these free samples, simply fill out and mail the coupon below:

KEUFFEL & ESSER OF CANADA, LTD., 679 St. James St., Montreal, P.Q.

Gentlemen:

Please send me your new brochure, titled “A Report on the Growing Acceptance of Polyester Film,” a sample sheet of HERCULENE Drafting Film, and samples of the Ruwe and Duralar Pencils.

Name & Title _____

Company & Address _____

4031

For further information mark No. 140 on Readers' Service Card

Design Notes on Temperature Control

"Why do you need PRECISE Temperature Control?"

In few product areas does the design engineer have such a broad choice as in temperature controls. And, as a further complication, in few areas is the performance-price relationship so difficult to determine. Though controls vary in price from a few cents to many dollars, in any given price range a small additional cost will often allow use of a substantially better control. You are, therefore, faced with our question: "Why do you need PRECISE Temperature Control?"

First, a definition of "Precise". This is a relative term. In a laboratory instrument, it could be tenths of a degree. In a household appliance, it could be several degrees. For our purposes, let's define it in two ways: (1) more precise than what you are presently using, and (2) control bandwidth not to exceed $\pm 5^\circ F$.

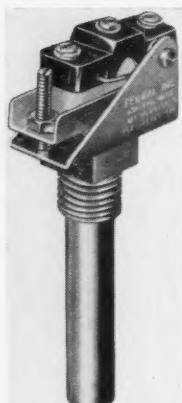
Obtaining Precise Control

1. Precision control is always a function of the thermal system. Proper heater sizing, relative locations of heater and thermostat, insulation, allowance for gradients, and the nature of the system — air or liquid, (still or moving), or solid — must all be considered. The more carefully you work out these factors, the better will be your control.
2. The controller itself. Even the best system will not perform precisely with an inadequate temperature control. The inherent sensitivity of the controller, its speed of response, and its repeatability will obviously make substantial differences.

WHY PRECISE CONTROL?

To cut down waste and improve taste in fried foods; to insure a better, more reliable seal in packaging; to guarantee a longer-lived product in tire recapping; to provide a more uniform output from a plastic machine — these are examples of "why" which can, in turn, be extended to cover nearly every product that uses a temperature control. "Precise" control, therefore, has its value in the fact that the end product that uses it performs better, lasts longer and sells easier. For the design engineer faced with the problem, there are additional advantages:

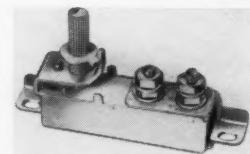
1. A precise controller can minimize the disadvantages of compromise. Though the correct thermal system design is essential to closest control, the nature of the end product itself, the problem of available design time, and the need to keep costs in line invariably require compromise. It stands to reason, therefore, that a precise controller will not impair a poor thermal system design — and can often improve it.
2. A precise controller can often lead to greater reliability. First, it prevents wide excursions of other components, such as heaters, which could be harmful if they occurred frequently; and, second, it insures that the user of the end product will have confidence in its repeatability, and consistency of results.
3. A precise controller can be an important sales benefit. It can represent a better product to the buyer, become evidence of special care in product design, and offer a significant competitive advantage.



1



2



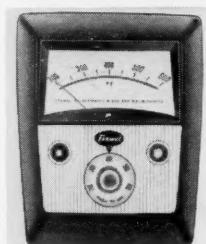
3



4



5



6

1: Fenwal 20,000 Series Liquid Expansion, Snap-Action THERMOSWITCH. Rated up to 20 amp. A.C. and 10 amp. D.C.

2: Fenwal 17,000 Series Differential Expansion, THERMOSWITCH. C.S.A. approved up to 10 amp. A.C. and 2 amp. D.C. from -100° to +600° F.

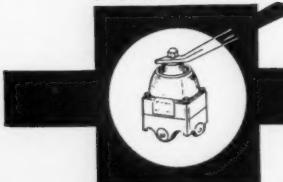
3: Fenwal 30,000 Series Surface Mounting Differential Expansion THERMOSWITCH.

4: Fenwal 32,000 Series Miniature Differential Expansion THERMOSWITCH.

5: Fenwal 541 Series Liquid Expansion indicating controller, -150° to +700° F.

6: Fenwal 561 Series Electronic (Thermistor) Temperature controllers and indicators, -50° to +600° F.

MONTREAL
TORONTO



ROUSSEAU CONTROLS LTD.

640 Decourcelle St., Montreal 30, P.Q.
2149 Yonge Street, Toronto 7, Ont.

For further information mark No. 153 on Readers' Service Card



TAKING THE TEMPERATURE OF QUALITY

The thermocouple shown here is as vital to the Noranda Metallurgist's job as a clinical thermometer is to a doctor of medicine. It is an essential link in the chain of quality control which, at Noranda, starts in the mine and continues through every stage in the production of Noranda copper and copper base alloys.

Noranda's complete range of rod, wire, strip and tube is quality-controlled to assure Canadian industry the ultimate in mill products for economical fabrication. Consistently high quality makes Noranda the prime source for copper, brass and bronze in Canada. We invite your inquiries for information and technical assistance.

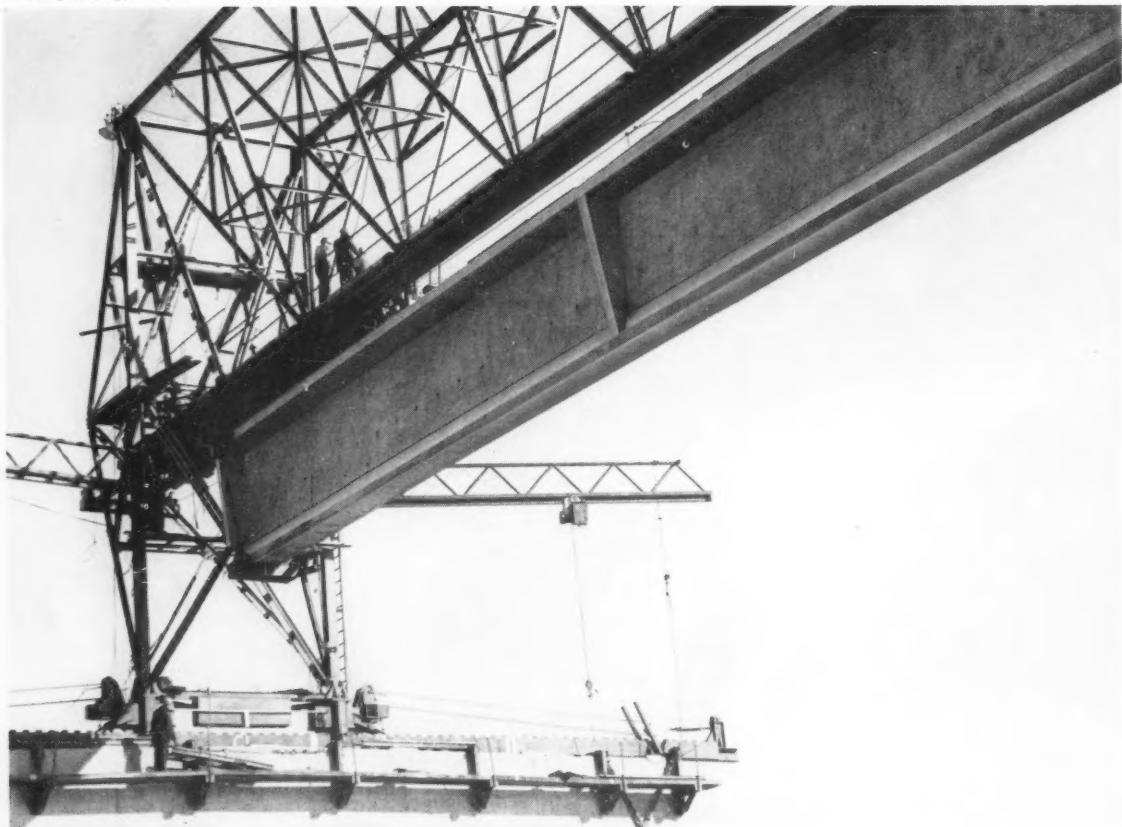
THE KEY TO THE BEST IN METALS

Noranda Copper and Brass Limited

SALES OFFICES: Montreal • Toronto • London • Edmonton • Vancouver

HYDRAULICS BY JARRY:

Champlain Bridge Contractors: McNamara-Key-Deschamps



a solution for you, too?

The photo shows the positioning of a 176' long, 10' high, 176-ton prestressed concrete beam on Montreal's new Champlain Bridge across the St. Lawrence. Making light of this ponderous job is a hydraulic system designed especially for the job by Jarry Hydraulics Limited.

Today more and more engineers are turning to hydraulics to solve problems. We have pioneered in hydraulics in Canada with equipment on every aircraft built in Canada since 1950. If you have an idea you'd like us to help you explore, write or phone the Sales Manager of our Industrial Division.

There are interesting openings in our Engineering Department.
Write: Vice President, Engineering.

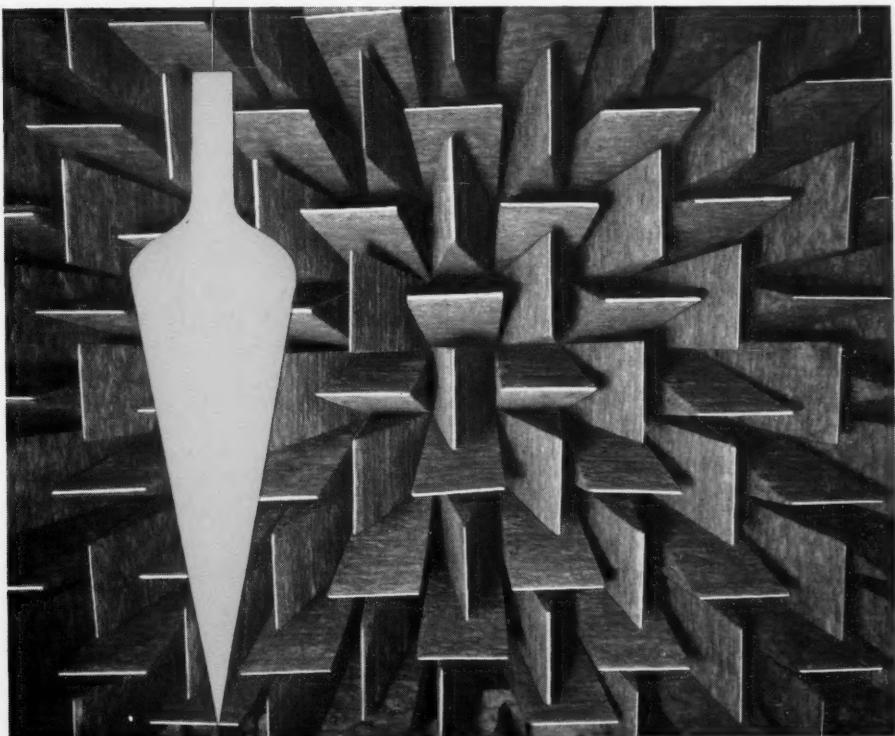
For further information mark No. 137 on Readers' Service Card

JARRY
HYDRAULICS LTD.
MONTREAL 18, QUEBEC

TO PLUMB NEW DEPTHS

IN SOUND, Northern Electric Research and Development Laboratories built a floating anechoic chamber. Although the appearance of this room is weird, its purpose is perfection; for here, there are no echoes, reflections or vibrations to distort the accuracy measurements of sound waves. ■ Wedges of Fiberglas, five feet long, project towards the middle of the room from all six surfaces, so that the equipment under test is completely surrounded by a mass of sound absorbent material. ■ This anechoic chamber is being used to test microphones, speakers, telephone transmitters and receivers, intercom systems and other communications equipment. ■ The chamber is an important new asset, but it represents just a fraction of the total facilities and personnel dedicated to the quest for progress in communications at the Research and Development Laboratories of Northern Electric Company Limited.

■ RESEARCH AND DEVELOPMENT LABORATORIES



Northern Electric
COMPANY LIMITED

SERVES YOU BEST

6660-26 .

For further information mark No. 148 on Readers' Service Card

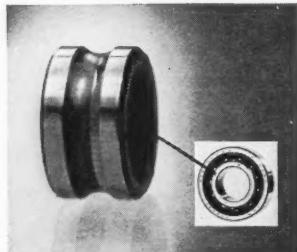
A NEW PRODUCT DEVELOPMENT FROM BARDEN

PERFORMING WELL IN A HOT SPOT



As every parent knows, small boys have an amazing capacity to perform well in heat that would fell the average adult. In much the same way, BarTemp* ball bearings operate effectively up to 575° F., permitting synchros, fans, control motors and other lightly loaded devices to perform at higher temperatures than ever before.

*TRADE MARK



▲ Unretouched photo of inner ring from BarTemp bearing that ran 2727 hours—1010 hours at 500° F. plus an additional 1717 hours at 575° F. Dark band in raceway is lubricant transferred from retainer.
▼ Excerpts from lab and field test results.

Bearing	Tempera-ture	Speed (RPM)	Hours
SR3HX110	500° F. 575° F.	1,200	2727
SR4HX110	338° F.	10,000	2500+
SR3HX110	392° F.	1,200	1240+
SR3BSSX112	500° F.	4,500	1036+
SR2HX110	575° F.	2,500	1628

NEW DESIGN DEVELOPMENTS

Two design innovations made BarTemp possible—a Barden-developed heat treatment for stainless steel used for the bearing rings, and a new retainer that serves as a dry lubricant and a ball separator. The BarTemp retainer, reinforced Teflon compounded with a solid lubricant, is the sole lubrication required. As the bearing rotates, the balls transfer microscopic particles of the lubricant to the raceways.

TEST RESULTS

In tests by more than 20 precision bearing users, BarTemp bearings in synchros, control motors, blowers, pressure switches, tachometer generators and other lightly loaded devices have operated from 1000 to 24,000 RPM and at temperatures from -100° F. to 575° F. Typical life exceeds 1,000 hours.

PROTOTYPES AVAILABLE

Prototype quantities of seven BarTemp sizes from .3125" to .7874" O.D. are immediately available in angular contact types, open or shielded. For further data and detailed test results, ask for BarTemp Data Sheet B-1.

Barden is a major supplier of miniature, instrument, spindle and turbine bearings volume-produced to ABEC 7 tolerances or better

for reliability...specify

BARDEN



PRECISION BALL BEARINGS

PHILIP FRENCH SALES, LTD. — Exclusive Agent in Canada
8425 Mountain Sights Avenue, Montreal 16
57 Dromore Crescent, Willowdale, Ont.

For further information mark No. 106 on Readers' Service Card



FIRST for supersonic jets . . .

NOW for industry . . .

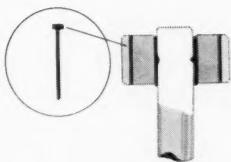
"SCOTCH-WELD"

BRAND

STRUCTURAL ADHESIVES

This amazing new "chemical welding" process enables you to fabricate without welds or rivets, solve design problems, and reduce parts assembly costs

Adhesive bonding of thin metal aircraft skins, metal braces, stiffeners and other parts was pioneered by the aircraft industry to develop stronger yet lighter, faster, higher flying planes. Certainly, if "Scotch-weld" Structural Adhesives are used to advantage in assembling multi-million dollar high-speed aircraft, they can also be used to advantage in load-bearing applications in many other industries. This modern, high strength method of joining metals, reinforced plastics and other materials, permits improved design and production techniques, cuts costs and offers many unique benefits . . . smoother contours . . . lighter gauge materials . . . reduced inspection . . . unusual combinations of materials, and so forth. Already, "Scotch-weld" Structural Adhesives have solved design and production problems for manufacturers of appliances, metal shipping containers, pneumatic tools, pumps, motors, scaffolding and many other items. They may be able to do the same for you. Mail the coupon and let us show you how.



Adhesive bonding small pinion gears to rotor shafts provided savings of \$56.37 per thousand by reducing rejects, and eliminating secondary operations and the necessity for 100% inspection.

A pump manufacturer reduced rejection rates from a high of 25% to nearly zero by adhesive bonding three separate die castings to form a single part.



**MINNESOTA MINING AND MANUFACTURING
OF CANADA LIMITED
LONDON, CANADA**

... where research is the key to tomorrow

For further information mark No. 145 on Readers' Service Card

MINNESOTA MINING AND MANUFACTURING OF CANADA LIMITED
Box, 757, London, Ontario

Please send me complete information about the new "Scotch-weld" Brand Structural Adhesives.

NAME.....

COMPANY.....

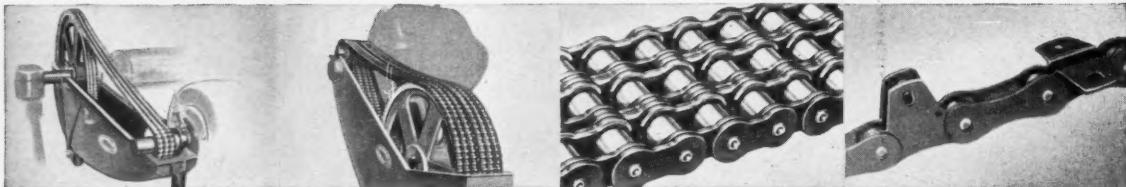
ADDRESS.....

CITY..... PROV.....

102305

For standard products unmatched in quality and price . . .

CALL RENOLD . . . FIRST NAME IN POWER TRANSMISSION

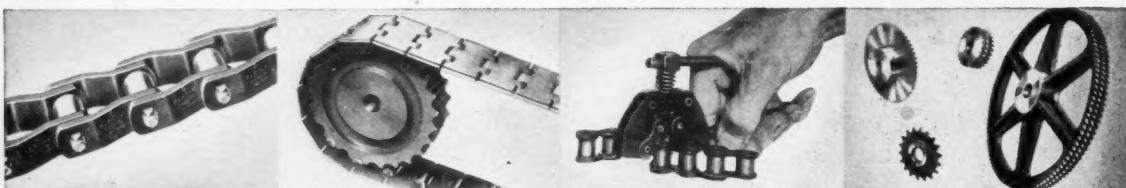


Renold B.S. Chain Drives—Stock delivery up to 140 h.p. Also wide range of standard cases and lubricators.

Renold B.S. Chain Drives—Prompt delivery up to 4000 h.p.

Renold A.S.A. Chains—a full range of single and multi-strand.

Coventry Steel Chains to replace malleable chains Nos. 32, 42, 50, 52, 55, 45, 62, 72½, 57, 67, 77, 75, 78, 88.

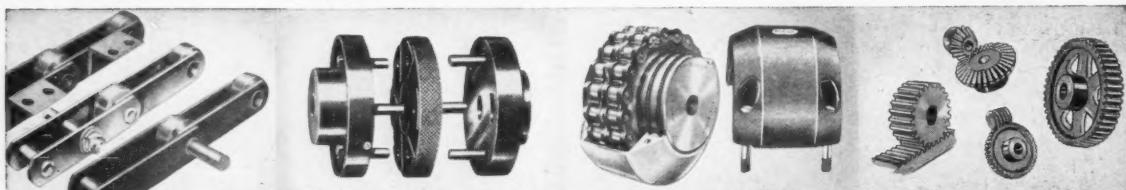


Renold Mark 3 Offset-Side Bar Roller Chains. Breaking loads 70,000 to 240,000 lbs. 2 in. to 5 in. pitch.

Coventry Slat Band Chains and wheels. Slats 3 in. to 7.5 in. wide. Stainless material or hardened mild steel.

Renold Chain Tools—for easy chain installation and repair. All sizes.

Renold Stock Wheels—Pinions and wheels are available for all Renold Chains.

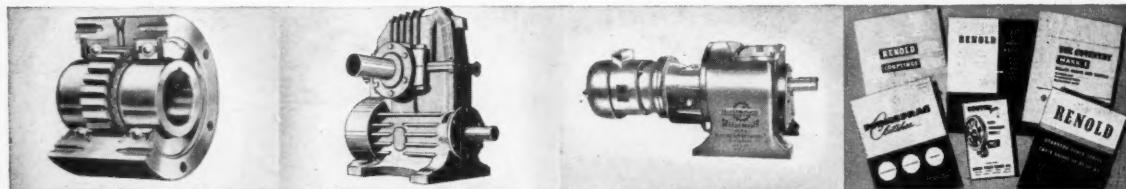


Renold Conveyor and Elevator chains. From 3,000 lbs. to 85,000 lbs. breaking load. Attachments and wheels.

Renold Disc Couplings—Up to 600 h.p. Max. speed 3,600 rpm. Spider type to 20 h.p. Max. speed 10,000 rpm.

Renold Chain Couplings—11 sizes up to 1,500 h.p. Maximum speed 5,700.

Boston Gears—Spur, worm and miter gears. Pinion wire and rack. All sizes.



Formsprag Clutches—Overrunning, backstopping and indexing. Standard and special sizes.

Reducers—Worm, helical and herringbone reducers. All sizes and ratios.

Geared Motors—Wide range from stock. Prompt delivery on larger sizes.

Catalogues—Write Advertising Department, 1006 Mountain Street, Montreal, P.Q.

RENOULD CHAINS CANADA LTD.

Branch Offices: Vancouver, Edmonton, Winnipeg, London, Clarkson (serving Hamilton and Toronto), Montreal, Quebec. Agents: E. S. Stephenson & Co. Limited, Halifax, N.S., Saint John, N.B., Hugh J. O'Neill Limited, Noranda, P.Q., Timmins and Sault Ste. Marie, Ont.

RENOULD CHAINS MANUFACTURING LTD. • BRANTFORD



CALL RENOLD... FIRST NAME IN POWER TRANSMISSION

For further information mark No. 151 on Readers' Service Card



information

Send your request for regular mailings of the Stelco bulletin "Drop Forgings Information".



This illustration is two and a half times actual size.

DROP FORGED by STELCO

...to give top performance in a tough job!

The pedal crank for a tricycle takes a good deal of abuse. It must have a high strength-to-weight ratio, durable toughness, and be economically priced to suit a competitive market.

Beginning with metallurgically controlled steels, Stelco uses modern techniques to produce forgings with unbroken grain-flow lines. The process provides finished parts stronger than the original steel from which they are made. Experience in die designing reduces finishing operations to a minimum.

For further information contact Stelco at Gananoque, or any Stelco Sales Office.

Please quote reference No. 360 when enquiring



Drop
Forge
Division

60272.8

THE STEEL COMPANY OF CANADA, LIMITED

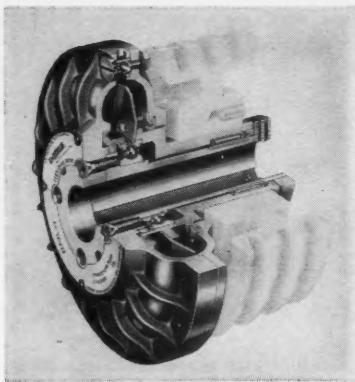
Drop Forge Division, Gananoque, Ontario

Sales Offices: Halifax, Saint John, Montreal, Ottawa, Toronto, Hamilton, London, Windsor, Sudbury, Winnipeg, Edmonton, Calgary, Vancouver. J. C. Pratt & Co. Limited, St. John's, Newfoundland.

For further information mark No. 158 on Readers' Service Card

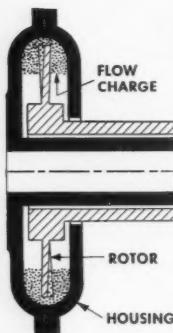
PRODUCT NEWS

FROM UNITED STEEL CORPORATION



FLEXIDYNE "Dry Fluid" Drives and Couplings provide a new way to: start loads smoothly, protect against overloads; reduce maintenance; save on

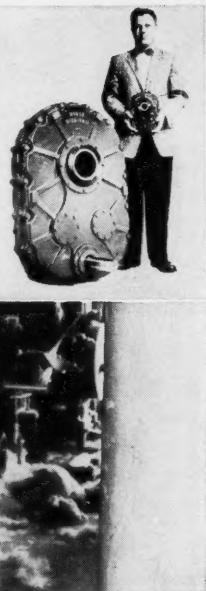
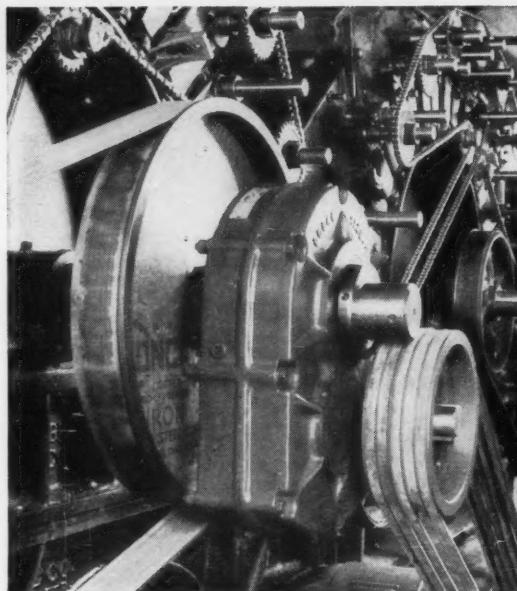
motors and controls. The "fluid" in Flexidyne is heat treated steel shot. A measured amount, called the flow charge, is contained in the housing, which is keyed to the motor shaft. When the motor is started centrifugal force throws the flow charge to the perimeter of the housing, packing it between the housing and the rotor which transmits power to the load. After the starting period of slippage between housing and rotor the two become locked together and achieve full load speed, operating without slip and with 100% efficiency. The Dodge Flexidyne Drive is available to handle from $\frac{1}{4}$ HP. to over 800 HP. **No. 6801.**



meter of the housing, packing it between the housing and the rotor which transmits power to the load. After the starting period of slippage between housing and rotor the two become locked together and achieve full load speed, operating without slip and with 100% efficiency. The Dodge Flexidyne Drive is available to handle from $\frac{1}{4}$ HP. to over 800 HP. **No. 6801.**

LIKE MORE FACTS? Simply check the item number and mail this coupon to: United Steel Corporation Limited, 58 Pelham Ave., Toronto 9.

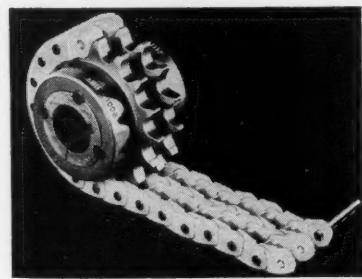
6801 6802 6803



TORQUE-ARM SPEED REDUCERS —

"Torque-Arm" is a precision built power package which simplifies problems of speed reduction and in so doing cuts the cost of equipment, installation and operation.

The reducer is mounted directly on the shaft to be driven thereby eliminating the need of costly linkage, foundation, sliding motor base or flexible coupling. Simple installation is effected by sliding the unit over the shaft and locking it in place with four screws. Combined with a V-Belt drive the Torque-Arm Speed Reducer can provide speed ratio up to 150-to-1 by selection of a predetermined combination of reducer and drive. Capacities up to 170 HP. with output speeds from 10 to 400 RPM. Overload Release and Backstop Mechanism, optional extras. **No. 6802.**



NYLON CHAIN COUPLING. Will outlast metal by as much as 6 to 1—costs less to buy and maintain. Specially suited for areas where corrosion is a problem. Ideal for loads fractional to 40 HP. and speeds 500 to 5,000 RPM. Used with standard $\frac{1}{2}$ " pitch roller chain sprockets. Quiet running; requires no lubrication or covering. **No. 6803.**

NAME.....

TITLE.....

COMPANY.....

ADDRESS.....

CITY OR TOWN..... PROV.....

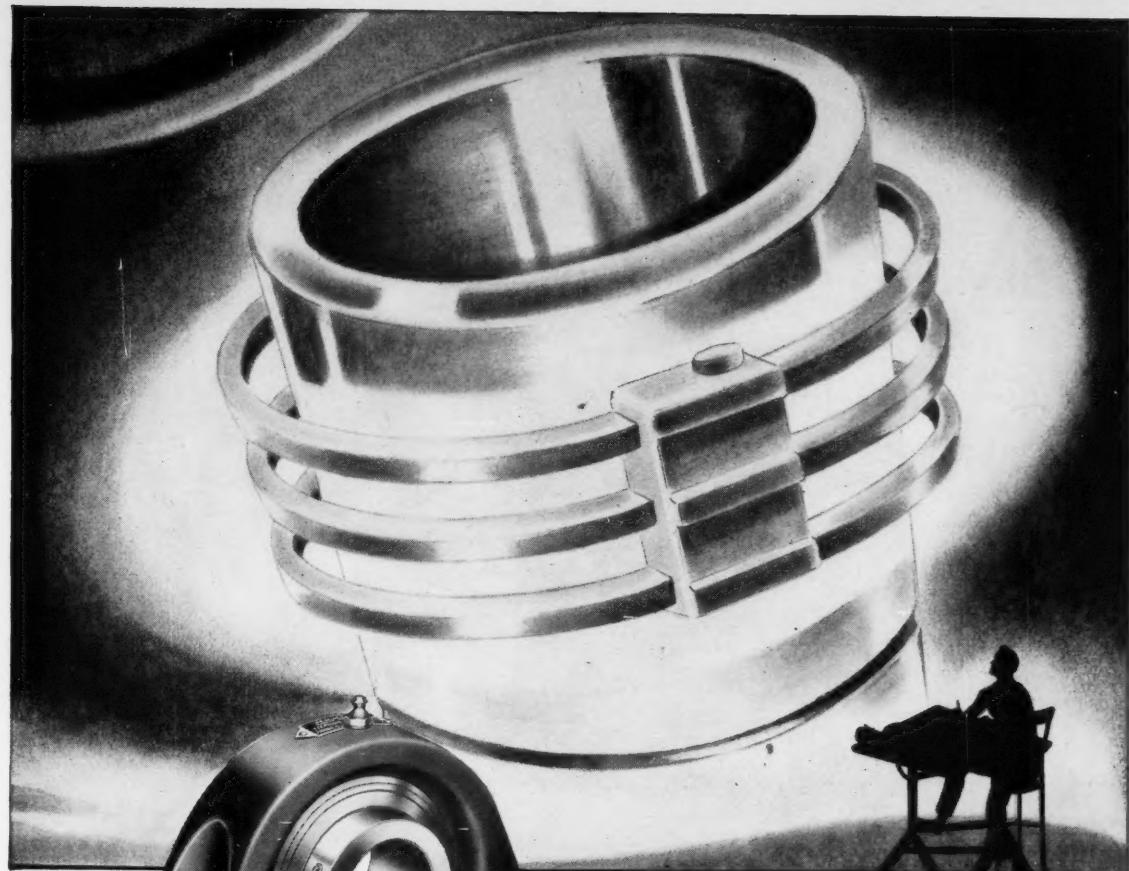
60-80



United Steel
CORPORATION LIMITED

TORONTO • MONTREAL • LONDON • GALT
WELLAND • KIRKLAND LAKE • SUDBURY

For further information mark No. 168 on Readers' Service Card



**THIS ONE FEATURE ALONE
MAKES SEALMASTER
OUTSTANDING**

ZONE HARDENING



SEALMASTER

BALL BEARING UNITS



SEALMASTER Ball Bearing Units provide a patented exclusive feature, **Zone Hardening**, which assures a positive race to shaft lock. **Zone Hardening** is a completely automatic heat treating process by which the inner race ring of SEALMASTER Ball Bearing Units is hardened through the ball path and adjacent section only. The extended portion of the inner race is left in its original metallurgically soft, tough state. Hardened set-screws are mounted through this soft portion of the race, permitting race-to-shaft locking with increased holding power and greater resistance to vibration and shock.

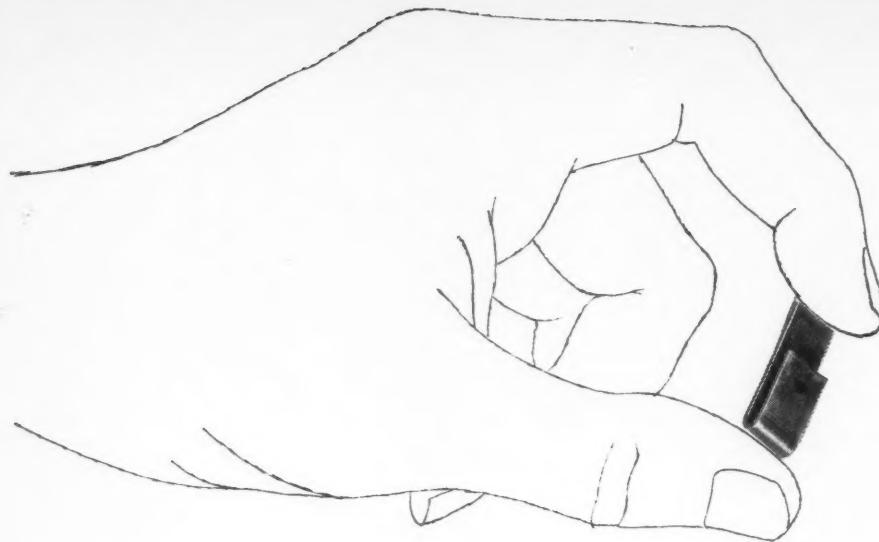
You'll want full information on the advantages of this and other **SEALMASTER** features—such as **Self-Alignment**, **Locking Pin** & **Perimeter Dimple**, **Labyrinth Seal**, **Floating Ball Retainer**, etc. Write for Bulletin 454 today.

SEALMASTER BEARINGS

A DIVISION OF STEPHENS-ADAMSON MFG. CO. OF CANADA LIMITED, BELLEVILLE, ONTARIO

S233C

For further information mark No. 160 on Readers' Service Card



IMPORTANCE COMES IN MANY SIZES

This stamping is one of thousands developed and manufactured by the engineering team of Wallace Barnes. Although it is small, it has an important part to play in the end product. It must be exactly right in design, temper, and performance characteristics to function positively and reliably in the product in which it is used.

To be sure your stampings are exactly right, get the benefit of Wallace Barnes' 500 man-years of experience in the specialized field of small stampings and springs.

Modern tool-making and production facilities are your assurance that each and every stamping will meet your specifications.

From creative engineering to prompt delivery . . . you can depend on Wallace Barnes.

Send for your FREE copy of "Pocket Guide to Springs and Other Things". A pictorial guide of our products and services.



**The Wallace
Barnes
Company Ltd.**

**Subsidiary of
Associated Spring
Corporation**

**Hamilton, Ontario
Pointe Claire, Que.**

**Sales Agent: E. A. Tipping Sales Ltd.,
Winnipeg—Vancouver (Richmond)**



64-230

For further information mark No. 173 on Readers' Service Card

Design Engineering

... drafting standards the foundation for a good standards program

The draftsman is the voice of the designer—it is imperative that draftsman and designer speak the same language, says Gordon Wells, standards specialist with CGE.

Every engineering drawing not only relates to subsequent manufacturing activity, but also influences the quality, performance and cost of the parts or assemblies it depicts.

It is the written language of the designer, and as such must convey to every user uniformly definable descriptions of material, size, shape, accuracy, finish and quality. It must be instantly translatable into direct manufacturing operations.

Modern industry has reached a state of development such that many standards are used unconsciously by draftsmen. However over-elaborated systems with a mass of rules, books, procedures and forms can shuttle more dollars down the drain than does an uncontrolled drafting practice.

Goals of standards program

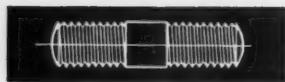
The basic goals of a good standards program may be stated as:

- Establishment of a uniform language (terms, description, illustration, reference)
- Reduction to a minimum of the varieties of size, kind, operation and process.
- Establishment of uniform levels of workmanship, accuracy and performance.

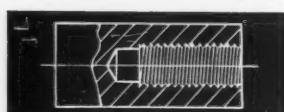
As we are considering only drafting, the fulfillment of the stated goals will be in terms of the drafting operation only. Nothing that is introduced at this time will require any performance on the part of a subsequent user of a drawing. The typical sections in a Drafting Standard on an industrial plant set-up are:

1. Drawing sizes.
2. Drawing format.
3. Drawing numbering.
4. Typical delineation.
5. Dimensioning practice.
6. Lines, lettering and notes.

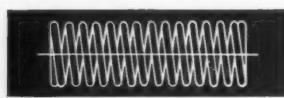
continued ▶



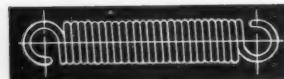
External screw threads



Internal screw threads



Compression springs



Tension springs

Conventional representation of common design features, per CSA-B78.1
Alternative practices are shown in each case.

7. Types of drawings.
8. Indexing of drawings.
9. Revision of drawings.

Coverage of the above subjects will produce a sound basic drafting standard. Referring to the table on page 46, it will be seen that these subjects are covered by National and Military Standards and these should be adopted if they apply. A successful standards program depends on the care exercised in the selection of National Standards, with full knowledge and consideration of the plant in which they are to be used.

While we have assumed for purposes of this article that "drafting" standards only are being set up, later the standards program will undoubtedly be expanded to take in other areas of operation. It is necessary therefore, to select and initiate with all the departments of the plant in mind because subsequently established standards will affect the functioning of, and depend on the performance of, the operating departments.

One word of warning—it is practically impossible to copy or adopt another plant's standard set-up. Each program, despite a common base, requires individual application.

Size, format and numbering

Drawing sizes are practically identical in all standards as they are based upon the economical use of standard paper. The use of standards of size permits the use of pre-cut sheets, pre-printing the forms and the use of standard cabinets. Some plants use only one or two sizes.

A uniform format for drawings permits quick and simple training in its use. The position of drawing numbers, title block, standard notes, and the position of data on material and finishes are all uniformly located for simple reading.

Numbering systems for drawings are subject to many opinions. The great division lies between "significant" and "sequential" systems. In the former, the number codes the item shown; in the latter the number simply identifies a drawing. The significant system can become very complicated and be quite inflexible as the quantity and complexity of the product increases.

Numbers may be keyed to sizes. IXXX may be "A" sizes, 2XXXX may be "B" and so forth. The drawing number may be prefixed by a size letter. With the development of a drawing numbering system, the decision must be made to provide recognition numbers or letters for parts and assemblies, to provide keys for revision and to include or exclude the parts lists.

Multiple part, tabulations of parts, patterns, dies and tools may form part of a well developed numbering system.

Delineation and dimensioning

"Typical delineation" is an important section. In this section are shown the conventions adopted, uniform ways to draw common products, whether holes or centres only will be drawn, how threads will be detailed, and many other uniformities. Through this section may be introduced any simplifications adopted; but it should originally be set up to follow mechanical (or electrical etc.) National Standard drafting practice, and simplifications introduced one at a time—and only after they had been fully understood and agreed upon by all subsequent users. This section requires great care and thought as it is developed because it controls the economic stability of the design.

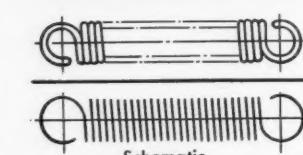
"Dimensioning practice" provides a key to uniformity and clarity in putting the size information on a drawing. Despite the fact that they are often presented together, "tolerancing" is not necessarily a part of dimensioning practice; as a standard requiring implementation beyond the drafting room, it is not included here.

All dimensioning should follow a uniform pattern so that the users may become readily familiar with one pattern. This reduces learning time and errors. Drafting simplifications can be effected in this section also. If the drawings are to be sent to sub-contractors outside the plant, no simplifications should be attempted.

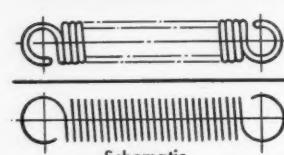
The "Lines, lettering, and notes" section should be easy to establish. The CSA-B78.1 section 2, or ASA Y-14.2 covers the subject fully. Adequate standards for any one plant can readily be selected from those sources.

Notes, or "what words should be added to a drawing?", are an often neglected part of a company drafting standard. It is important that uniformity of wording and type of lettering used be established for notes. Some notes are repetitive, these may be added by means of rubber stamp or preprinted adhesives. A list of standard notes should form a part of this section.

Many notes normally added to drawings make reference to standards which are not themselves included in the drafting standards. Notes are used to



Schematic



Schematic

Tension springs

Conventional representation of common design features, per CSA-B78.1
Alternative practices are shown in each case.

designate materials, finishes, special practices, tests, etc., which appear on drawings but are standards to which the plant operations conform.

"Types of drawings" is industry based. Nearly all industries have fabrication drawings of parts, assemblies and sub-assemblies. There are also purchased part drawings, diagrams, schematics, outlines, installation, foundation and wiring drawings. In processing industries the drawing may deal exclusively with plant and equipment; in some apparatus plants only with tools, jigs and special machines; in military work, fabrication, standard part, specification control and source control are some of the established types.

This section should set out in general terms what types of drawings are needed for the plant and what the content and coverage should be for each type. Rules for drawings intended for customer use should be established as these drawings convey to the customer an indication of the quality of the products they depict. Diagrams should follow the practice of the industry.

Indexing, titles and names

"Indexing of drawings" is such a controversial subject that it is necessary to establish definite rules for each plant. Where continuous production of a few products is the rule or when unrelated batches are produced, or when every part, in small or large quantity is different, there are very good reasons for not indexing drawings at all. When many parts with or without modification are used to make more or less uniform assemblies or a family of assemblies, the indexing of previously drawn parts can be very important.

With "Indexing" comes the necessity of "Standard drawing titles and names." While the Military have a standard for this, and it has recently been brought into focus by the increase of Federal cataloging, industry in general has done little about it. It is difficult to index parts when, say, a heat treating furnace has a drawing for a left side, right side, top, bottom, four legs and four feet and the first four drawings and the last are called "Plate-Furnace" and the leg drawing is called "Channel." A few simple rules will help here:

1. No drawing should be titled the name of a standard shape, form or part. (NOT plate, channel, washer, screw.)
2. The function of the drawing alone should not be used as a title. (NOT Assembly, Plan, Layout.)
3. The title should refer directly to the subject of the drawing. (Bearing, Base, Lever.)
4. Enough extra wording should be used to differentiate between drawings of like parts. (Bearing, Ball, No. 309, Base, 3 in. pump, 6 in. adjustment.)
5. Titles should be uniform. (There should be a title reference index in which acceptable titles are listed.)

Indices tend to grow over-elaborate (and expensive to maintain) unless well established and documented in advance. They may be a card file, books of reference prints, microfilm, film cards or combinations of any of these.

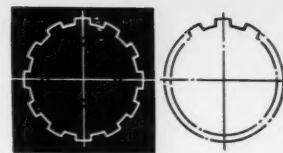
Index cards are in many instances initiated by the draftsman with the drawing itself. Since the draftsman is the user of the card, he tends to make as lucid as possible. When permanent cards are prepared subsequently by the clerical staff, they are often merely copies of little understood words and may, after filing, give little intelligible information to the user of the file.

Books of reference prints are feasible when the parts or assemblies they show are relatively staple and established. A complete file of prints of all drawings for reference also requires much maintainance and tends to become dangerously obsolete unless fully, and often expensively, kept up to date.

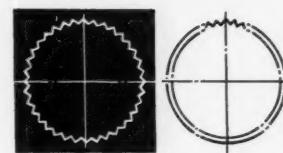
Microfilm and microfilm cards are quick, accurate references if revisions can be incorporated into the system without delay. They can be used for automatic card, or tape actuated drawing reproduction when the operation is large enough to cover the high cost of installation. In any case, auxillary equipment readers, printers, etc., are necessary for their use.

In smaller and more compact plants, a set of reference data sheets may be used to accumulate part assemblies, diagrams and other information for the use of the draftsman and designer. Carefully classified and grouped, this is one of the most rapid systems known, as the user can have the data on his desk and no searching of files is required. There must be means, however, to keep the various data sheets up to date.

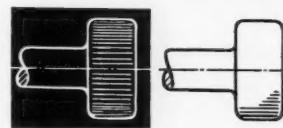
"Revision of drawings" has been shown last in the set up of drafting standards, because theoretically there should never be a need of revision. The drawing may be revised however, to correct errors, to add information, and to change information. When the drawing is an assembly, it may be changed to incorporate new or improved parts. If the product it shows goes to an ultimate user, it is necessary to know exactly when changes occurred. *It is often preferable to set up a new drawing rather than to revise.* A new number should



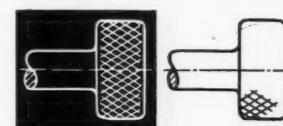
Splined shaft



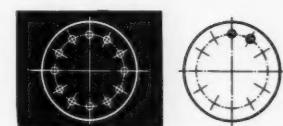
Serrated shaft



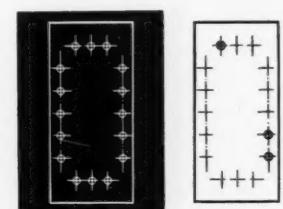
Straight knurling



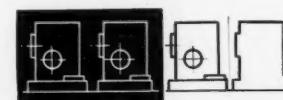
Diamond knurling



Holes on circular pitch

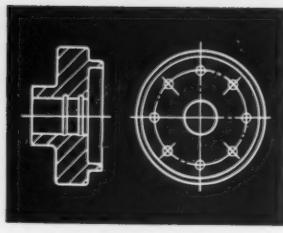


Holes on linear pitch



Repeated parts

continued ▶



Conventional drafting practice for symmetrical parts reduces drawing time.

be given a drawing if it affects:

- C — Co-ordination of the parts
- L — Life of the product
- I — Interchangeability of part of product
- F — Function in any way
- S — Safety—Standards

This is called the "CLIFS" system and has been adopted by many companies as their guide.

The success, in terms of economy, of a standard drafting system in any plant depends on the study and pre-planning that goes into it. A full and complete knowledge of the plant, its products and the industry of which it is a part, is a necessity. The consideration, not only of the drafting room but of the design engineer, the methods and operation planner, stores and inventory section, purchasing agent, shop operating departments, inspectors and quality control groups will bring their functions into focus with respect to the standards being introduced.

The actual rules formulated seldom have to be invented. In every field there are sound and adequate standards for almost every situation and practice. However new practices, parts or materials may have to be developed; these may in time become the base for an industry, and eventually, a National standard.

Later, other standards may be introduced into the system. Welding symbols, machine finishes and material specifications may be added to the drawing as it is the vehicle by which these practices are initiated. As stated before, these standards are implemented by subsequent departments and can be introduced only when fully documented, explained and understood by the operating groups. They must be introduced simultaneously into shop and drafting room.

We recommend that standards be recorded in a distinctive format, with their own numbering system. Standards should never be presented in the same form as regular drawings. Finally, make your standards book a "working book," and not a shelf-borne "reference." *

Table 1: Standards reference

title	ASA	CSA	Military	Miscellaneous
Drawing sizes	Y-14-1	B78.1 sect 1	MIL-STD-2	
Drawing format	Y-14-1	B78.1 sect 3	MIL-STD-3	
Drawing general practice	Y-14-3	B78.1 sect 4	MIL-STD-1	MIL-D-70327
Types of drawings			MIL-STD-7	
Dimensioning	Y-14-5	B78.1 sect 5	MIL-STD-8	
Lines and lettering	Y-14-2	B78.1 sect 2		
Drawing titles			MIL-STD-28	
Drawing revisions			MIL-STD-24	
Graphical Symbols				
Electric and electronic	Y-32-2		MIL-STD-15	CGSB-33GP-1
Structural	Y-10		MIL-STD-18	
Welding	Y-32-3		MIL-STD-19	
Gears	B6.1 to 10			
Forging	B24.1			
Machine finishes	B46.1		MIL-STD-10A	
Unified screw threads	B1.1	B1.1		ISO-R

Table 2: Standard drawing sizes

references:	Drawing size	overall		trimmed		inside border	
		width	length	width	length	width	length
CSA B78.1	A	9	12	8.5	11	8	10.5
ASA X14.1-1957	B	12	18	11	17	10.5	16.5
UDC 621.7.744	C	18	24	17	22	16.25	21.25
MIL-STD-2	D	24	34	22	34	21	33
	E	34	44	34	44	33	43



Are draftsmen downgraded in Canada?

**A man with experience in
the British system concludes
that our way results in a
waste of engineering talents**

If you were to ask the question "What is the difference between an engineer and a draftsman?" it is quite likely that you would get the reply "An engineer is a member of the Association of Professional Engineers, and a draftsman is not". This is the shortest and simplest answer to the question; they belong to distinct and separate groups. And thereby hangs many a problem.

The Professional Engineer in Canada has a high degree of technical education, usually gained at uni-

versity, and finds his work in the top level jobs in the production, design, and sales fields of engineering.

Draftsmen in Canada, on the other hand, do not usually have such a high degree of technical education, and their work is often confined to one field of engineering. They produce engineering drawings, and the degree of skill and responsibility varies with their status as junior, intermediate, and senior draftsmen.

The more complicated design work and calculations are generally carried out by an engineer. Thus only the very simplest calculations and design work is left to be done by draftsmen.

It's different in Europe

Now let us suppose the same question "What is the difference between an engineer and a draftsman" were asked in an European country, like Britain for example. There the question could not be answered so simply, because they have no association of professional engineers. The top level men in engineering are usually given specific titles which make no recognition of whether they are university trained or not. The titles usually indicate the types of work performed.

A chief designer, and sometimes a stressman to take care of the more complicated stress calculations, are generally the only people at "engineer" level who work in the design field.

Draftsmen usually serve a five-year apprenticeship with their firm, and this includes a course of technical training which culminates in the award of the Ordinary, or Higher National, Certificate of Mechanical Engineering. These certificates, plus a number of years' experience in the drafting room, are usually considered sufficient to fit a man for the position of senior draftsman.

continued ▶

The work of a senior design draftsman in Britain and other European countries often embraces the whole of the design work on a new project. The chief draftsman and chief designer serve in an advisory capacity, and approve the work done by the draftsmen.

It will be seen that generally speaking, the draftsman in Europe is given a greater degree of responsibility in design work than his Canadian counterpart. This fact assumes quite a large degree of importance when we consider that large numbers of draftsmen immigrate to Canada each year from Britain and other European countries.

Many of these draftsmen come to Canada after they have qualified as senior men. On arrival they usually find that they are forced to accept jobs at a grade or two lower than they had previously. They do this thinking that at a later date they can move to a job more in keeping with their capabilities. Few manage to do so and the remainder soon discover that it is necessary for them to become professional engineers in order to move to a higher grade of work. Few newly arrived immigrants can pass the required examinations, and as a result, they are forced to suffer the frustration of doing an inferior grade of work.

This is not good from the point of view of the draftsman, and since because of this, so much of the talent and engineering experience coming into the country is wasted, it is also not good for industry and Canada as a whole.

What needs to be done

What then can be done? There does not appear to be any one simple answer to the problem. A great deal might be done by the employers. Also, the facilities for technical training could also be considerably improved.

The Association of Professional Engineers in Ontario issues certificates in five grades for engineering technicians. This gives official recognition to draftsmen not qualified to be professional engineers, but unfortunately there is virtually no means provided for a person to take a course of training to up-grade himself. There are evening classes for draftsmen available in some cities of Ontario but these classes should be standardized, and examinations set, that would qualify successful students for a certain grade of engineering technician. These courses could start at any level, but preferably at High School Grade 13, which is equivalent to grade one engineering technicians, and continue right through the five grades and up to the professional engineering level. If the cost of these courses were kept to a reasonable figure, it would enable anyone to start in at his appropriate level, and work his way up if he had the inclination and ambition.

It would also be necessary for industry to play a part in the scheme too. They could for example provide incentive by setting their salary levels according to engineering technician grades, and further encouragement could be provided by offering to pay the fee for any of their employees willing to take a course.

In the meantime employers in Canada could help to alleviate the situation by advertising for a designer, or design draftsman, when they need one, instead of asking for an engineer. This would then enable any draftsman who feels he can handle the job to apply, and would give the employer a wider selection from which he would be better able to find the best man for the job. *

Double trouble with double dimensions

**At best it wastes time,
at worst it means the loss
of costly components.**

A practice to stay away from...

W. E. Dayer

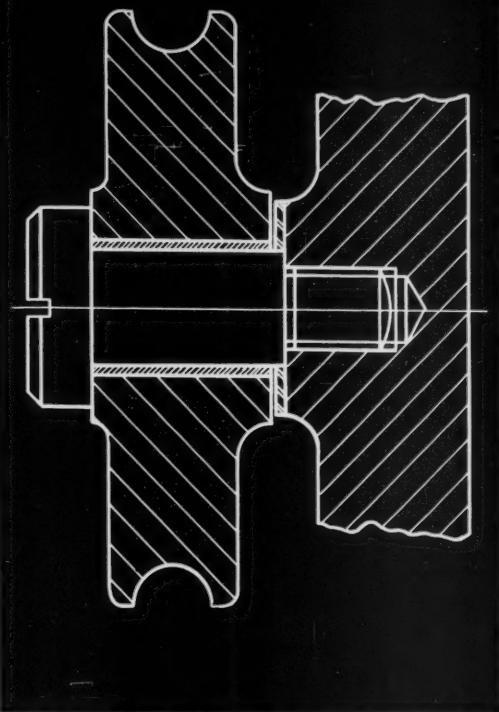
The practice of putting dimensions on an engineering drawing over and above the minimum number required to manufacture the component is known as double dimensioning.

The subject is a controversial one in drafting rooms, with many draftsmen firmly believing in the practice and others just as firmly condemning it. Many engineering firms also take sides by laying down an official policy for their draftsmen, usually against the practice. But many other firms leave their draftsmen to please themselves, and double dimensioning is often used on drawings in these cases.

Sometimes a chief draftsman or engineer will unconsciously set the pattern by asking for another dimension here or there when checking over a drawing. As a result the draftsmen come to anticipate this request and put the extra dimensions on beforehand. On other occasions, doubts born in the mind of perhaps an inexperienced draftsman may cause double dimensioning. On finishing a drawing, he may not be sure that he has put in all the dimensions required, so he goes over the drawing again, and often adds more dimensions — "just to make sure". Also, workmen inexperienced in the reading of drawings can cause this sort of thing by requesting extra dimensions from another face because it is more convenient to read the drawing that way.

Why double dimension?

All the reference books on engineering drawing we have seen teach the single dimensioning method, and this includes the official standards of the Canadian Standards Association. Why then do many draftsmen practice double dimensioning? We have heard many reasons given by its adherents, but never yet one that has convinced us it is right. One of the most common



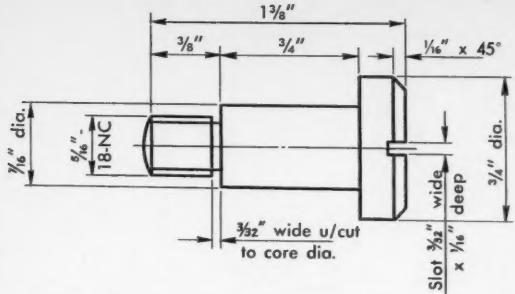
1. Sub assembly drawing of small pulley wheel and bolt.

arguments is that it saves the men in the shop adding up dimensions. This is not true because there is no need to add dimensions with proper single dimensioning — in fact it is quite wrong to do so.

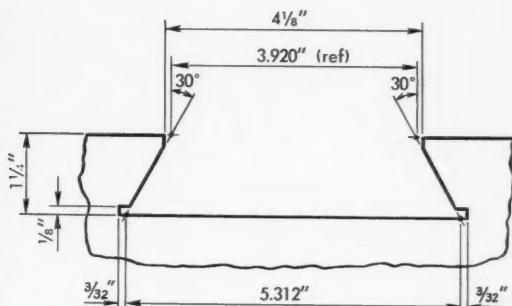
Let us take a simple example. Suppose a drawing is made of a flagpole; it is 30 ft long, with a pivot hole 6 ins. from the base end. The correct linear dimensions for this would be to give the over-all length of 30 ft and a 6 inch dimension from the base end to the centre of the hole. To double dimension in this case would be to add a further dimension of 29 ft 6 ins. from the centre of the hole to the top end.

It is quite unlikely that the man making the flagpole would measure 29 ft 6 ins. from the top end to mark off the hole; furthermore, he does not even need to know this dimension, for if the over-all length is correct and the 6 in. dimension to the hole is correct, then the 29 ft 6 in. dimension will come right automatically. He needs only to check these two dimensions to ascertain that the flagpole is correct to drawing, and it is quite unnecessary for him to figure out the 29 ft 6 in. dimension and check that. So the man in the shop has no need to add or subtract dimensions and lengths that are undimensioned can be ignored.

To carry this example a stage further, let us imagine that the hole has been marked off from the top end and drilled accordingly. If the over-all length is correct, no harm will be done; but if the over-all length is, say, one inch oversize, then the hole will be 7 ins. from the base end instead of 6 ins. as intended. This may cause interference with the mounting and necessitate an extra operation to remove the excess one inch, whereas if the 6 in. dimension had been worked to, the exact extra inch would be at the top of the pole, where it does not matter.



2. Single detail drawing of shouldered bolt.



3. Dovetail slideway showing added reference dimension.

Of course this is an extreme case and would probably not be double dimensioned anyway, but the same principle applies in all cases. In machined parts, for example, the machinist, if given the choice, may work to unimportant dimensions which have been included because it is more convenient for him.

Function is first consideration

In dimensioning, first consideration should be given to the function of the part, and its relation to adjacent parts in the assembly. This will ensure that scrap, and fitting on assembly is kept to a minimum, and that parts will be interchangeable. Convenience of machining should also be considered wherever possible, but only when function is not sacrificed. A typical example is illustrated where a small pulley wheel is mounted on a shouldered bolt. In the case of the bolt, the most important linear dimension is the length of the shoulder, and the least important dimension would be the thickness of the head. The part should therefore be dimensioned as shown in figure 2.

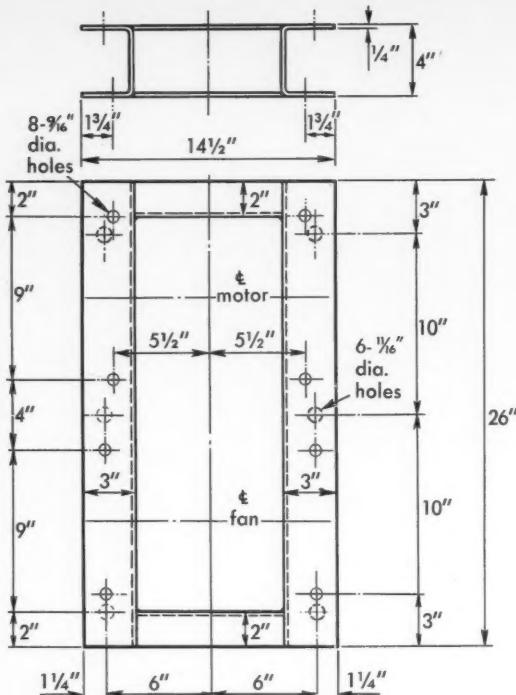
To double dimension in this case would be to add the thickness of the head, which might lead the machinist into working to the two end dimensions and ignoring the shoulder length. Thus, if the over-all length is short, the screw may tighten up on the pulley, instead of the shoulder.

In the case of turned components such as this, a chain of dimensions adding up to the over-all length is undesirable, and the least important one should be omitted.

Reference dimensions are needed

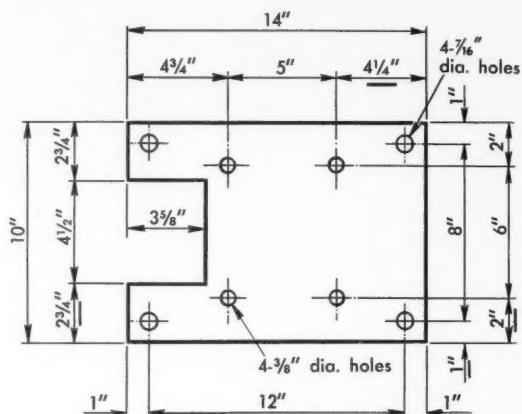
With fine precision work, the necessity for limits on dimensions generally discourages double dimensioning. There are, however, some occasions when extra

continued ▶



4 (left). Channel frame mounting base with double dimensioning. The $1\frac{3}{4}$ dimensions should have been omitted.

5 (below). If the underlined dimensions had been omitted, both boltholes and recess would be located from the same datum faces.



dimensions are required for checking. These should always be marked, such as the suffix "REF" to tell the shops that this is a reference dimension for checking or inspection purposes only.

Bolt holes are a common source of trouble when double dimensioned. For example, two components that are bolted together through identical flanges may not line up very well if double dimensioning allows one component to be marked off from a different location face to the other. On the other hand, if both components are single dimensioned from the same datum faces, good linability will result even if the two components are made in separate plants.

In the days before the industrial revolution, the proper fitting of parts depended upon craftsmen in the shops who skillfully "fitted" each part to mate perfectly into the assembly. Today, with mass production and automation, this skill and craftsmanship are replaced by the intelligent use of dimensioning and by the fine limits modern machine tools are capable of working to. Thus parts not only mate together without skilled hand fitting, but are also interchangeable. Double dimensioning undermines this principle.

Double dimensioning costs money

Apart from chain dimensions, there are other ways in which double dimensioning can manifest itself. An example is shown in fig. 4. Here the same information is given in two different ways in two separate views on the drawing. The double dimensioning can easily be picked out on the simple example given, but on a complicated drawing it can be very difficult to notice and therein lies the danger. Suppose a revision necessitates the changing of this information.

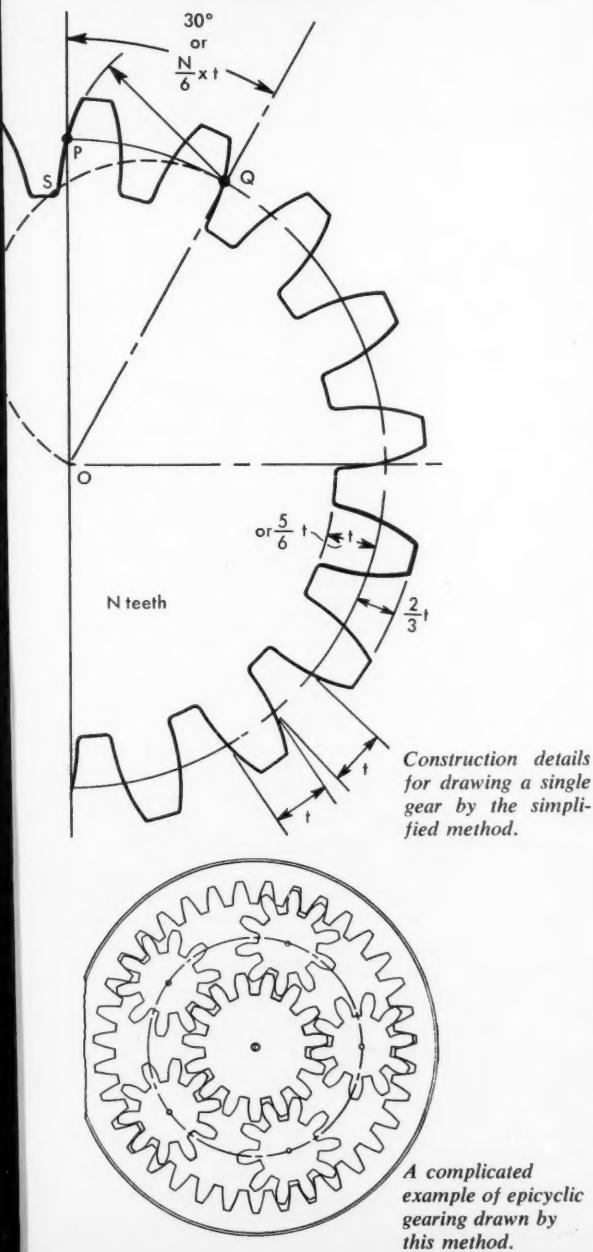
A draftsman revising the drawing may change the dimensions in one view, and quite understandably fail to notice that the same information is given in another view. You then get the peculiar situation where a dimension is given as one thing in one view and something different in another view, and it's a 50-50 chance whether the shop work is going to be done to the right dimension or the wrong one. If they work to the right one there is no harm done, but if they work to the wrong one it may mean some parts have to be scrapped or need extra operations to put them right. On the other hand, perhaps the shops will spot the discrepancy and report it. In this case the only harm done is to the prestige of the drafting room, plus perhaps a little time wasted.

Double dimensioning can and does cost money. At best it is a time waster in the drafting room; at worst it can cause expensive components to be scrapped through discrepancies on drawings. It may cause a subtle and continuous drain on expense by increasing the percentage of scrap, increasing the percentage of parts that require extra operations, or hand fitting to ensure correct assembly. Such things as elongating bolt holes and skimming faces to ensure clearance fall into this category.

An excellent book called "Technical Drawing" published by the MacMillan Company of New York sums up the subject very neatly. The passage reads: "The dimensions should be so given that it will never be necessary for the workman to calculate, scale, or assume any dimension in order to make the part as intended by the designer. Dimensions should never be duplicated on a drawing and no dimension should be given except those needed to produce or inspect the part."

Shortcuts for drawing gear teeth

Expert suggestions to help solve a difficult drafting problem



The problem of drawing gear teeth is one that regularly confronts the engineering draftsman. While the shape of the gear teeth is usually involute, it is satisfactory for most drawing purposes to use circular arcs.

For production drawings the addendum and dedendum circles are usually drawn, and two or three teeth sketched in by some hit-or-miss method. However it is sometimes necessary, particularly in the preparation of brochures, catalogues and displays, to draw in a full set of teeth. The greatest difficulty occurs in meshing the teeth, and more particularly if they happen to be epicyclic gears. Methods for doing this have been published and they generally require the drawing of an auxiliary circle for the centres of the arcs. The following is a much simpler method of construction, eliminating the need for the extra circle and using instead the pitch circle.

Drawing a single gear

Consider first the problem of drawing a single simple gear. Draw the pitch circle to the required diameter and determine the number of teeth, using conventional methods. For meshing gears, a diametral pitch must also be decided upon.

Diametral pitch (DP) = N/D where N = number of teeth and D = pitch circle diameter.

Now divide the pitch circle into parts equal to twice the number of teeth, giving a series of pitch points for teeth and gaps. The direct distance between consecutive points is taken as 't', whence the addendum is $2/3t$ and the dedendum is t or $5/6t$. The appropriate addendum and dedendum circles are then drawn.

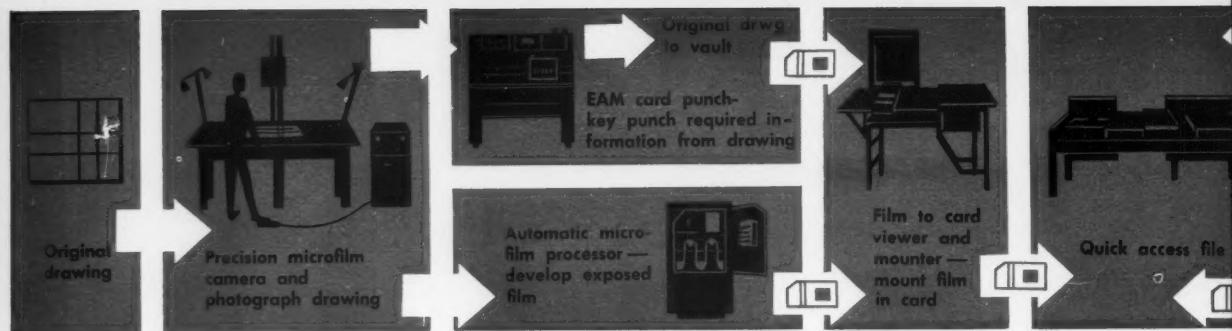
A radial line through one pitch point and another line at 30° to the radial line are next drawn (OP and OQ in the illustration). The required radius for each arc is then PQ. This corresponds to a pressure angle of 15° , and is satisfactory for most drawing requirements. Use the pitch line for centers, and radius twice the circle of curvature of the involute at the pitch point. If the centre of the pitch circle is inaccessible, as for a curved rack, the radius of the arcs may be taken as $Nt/6$.

Some other considerations

Theoretically the arcs should extend to the base circle to which the pitch line is tangential, but the aesthetic qualities of the drawing are improved if the arcs are continued to a pitch at which the radial lines are tangential. Drawing a semicircle on OQ gives the point S, the limit of the tooth arc. A corner radius can now be easily added.

The second illustration shows a complicated example of epicyclic gearing, again drawn using the principles outlined. In the case of the internal gear the properties of the addendum and the dedendum are reversed. In this case also, the arcs are not continued to the radial lines.

For straight racks, the flanks may be drawn at 15° obliquity. This is also satisfactory for drawing worms and Acme type threads. *



Automating the drawing office saves \$

Westinghouse saves two ways by automating its engineering drawing offices.

The tangible savings are in space for drawing files, in their cost and in operating costs. Intangibles are that microfilm intermediates are quickly available and punch information provides flexible reference.

In the past few years, the use of microfilming in the engineering field has become increasingly important and is being studied by many industries, both large and small. Here is how Westinghouse Electric Corporation attacked this problem at East Pittsburgh.

For years, all Westinghouse locations microfilmed drawing for security purposes. The microfilm rolls were carefully indexed and filed in underground storage vaults.

Today Westinghouse is not microfilming drawings for storage, in case of an atomic bomb. Instead, Westinghouse is microfilming for "active" use in line with an atomic age.

For all practical purposes, Westinghouse has retired the engineering tracing. The sole function of their engineering tracings is to provide the necessary media from which an active working microfilm can be prepared.

Quantities beyond imagination

The East Pittsburgh Division of Westinghouse employs 400 draftsmen in creating new or revised drawings. Each year, more than 30,000 new drawings are prepared and more than 54,000 existing drawings are revised.

Daily, they process more than 3,000 requests for engineering drawings that result in 16,000 prints. Yearly, their reproduction of engineering drawings uses twenty million square feet of paper.

It was because of this large volume of paper work that their top management accepted the challenge and are now using an automated reproduction system.

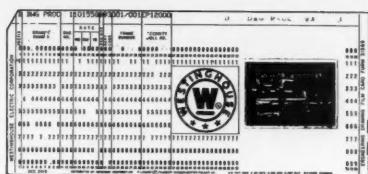
Of course, the approval of top management alone did not put this complex system into immediate being. Many questions had to be answered, pieces of equipment surveyed, and problems solved.

Action by committee method

The first direct step towards automating engineering drawings was to form a committee. This committee went into immediate action.

LIST OF DRAWINGS MICROFILMED WESTINGHOUSE DIVISION 3510		2 Prints		6/m		PAGE OF	
PROJECT NO.	DRAFTS NO.	PROJECT NO.		ITEM NO.	ROLL NO.	PAGE OF	
		MONTH	DAY			ROLL SIZE	EP
D 150 8945	2	11	28	58	A	/	1301
279 8 905	2				B	/	1301
274 8 270	1				B	/	1304
274 8 291	1				B	/	1304
208 7 939	3				C	/	1301
380 8 644	3				C	/	1304
381 8 768	3				C	/	1301
383 8 359	2				C	/	1301
383 8 531	3				C	/	1301
383 8 564	2				C	/	1301
384 8 112	1				C	/	1304
384 8 115	1				C	/	1304
384 8 122	1				C	/	1304
384 8 123	1				C	/	1304
513 D 283	1				D	/	1304
513 D 284	1				D	/	1304
517 D 204	3				D	/	1304
517 D 276	3				D	/	1304
518 D 282	3				D	/	1304

This list of drawings governs the input procedures for the handling system at Westinghouse.



A typical card used in this system.

The committee had just three weeks to make its preliminary studies and to present management with enough information to assure the feasibility of an automated drawing system. Specifically, the committee was charged with the following:

1. Review equipment available and under development in the drawing process field with emphasis on microfilming equipment.
2. Review present operations in the drafting and processing sections of East Pittsburgh Division of Westinghouse.
3. Plan a pilot line storage and reproduction system for early installation.
4. Plan one or more drawing processing systems which would meet the needs of the East Pittsburgh Division and present them to management with the necessary data for evaluation.

The members of the committee, representing both services and line management, were fortunate to have people with experience to assist them. A standing committee, known as the Drafting Practice Committee, was called in. The senior supervisors of the Westinghouse drafting offices are members of this group. Within their own plants, these supervisors are responsible for the preparation of over 90% of the company's drafting. Their aid and co-operation was both invaluable and necessary for the introduction of an automated drawing system, since they were the people who would have to make the system work.

The committee found there were many users of the combination microfilm-tabulating card now widely known as the aperture card. Police departments, hospitals, insurance companies, banks and many other business institutions were using them.

However, very few industrial organizations had really put aperture cards to work. The committee, of course, was aware of the passive microfilm systems, such as that used at East Pittsburgh for security purposes.

Within the time limits set, the committee submitted a report to top management. Enthusiastically, the committee supported the idea of installing an extensive automated drawing system. Although time did not allow detailed financial figures, there was every indi-

cation that the installation of such an automated drawing system could pay for itself within a few years.

Top management quickly accepted the committee's findings and further emphasized that such a system should be installed as early as possible.

How one department made the change

The Power Circuit Breaker Department provides a good example of how readily the proposed system was accepted. Shortly after the committee action, the entire operation of this department was expected to move into new quarters.

The manager of the Power Circuit Breaker Department announced that he expected the automated drawing system to be so well organized that it and it alone would be moved into the new plant.

As part of this story, it might be added, an immediate savings in operating costs was realized because of the advantages inherent in the punched card system as compared with full-sized tracings. In preparation for the move, the Power Circuit Breaker Department had started the manual review of the full-sized tracings in the vault to determine which tracings would be taken to the new location.

It soon became obvious that tracings of Power Circuit Breaker products along with all other drawings would be converted to aperture cards. Once the Power Circuit Breaker drawings were in card format, it was simple because of the card coding to pull out the drawings needed by that department. Of course, this bonus savings was not considered by the committee at the time of its proposal to management.

The system the committee had in mind was made possible by three major developments:

1. Improvements in the quality of microfilm.
2. Supplies and equipment available, making it possible to mount economically 35mm files on tabulating cards.
3. The development of continuous electrostatic printers in which the aperture cards could be used in making paper copies.

A pictorial flow chart was made of the proposed system. The chart, along with a second report out-



Cards and requisitions from filing department go to 24 in. Haloid Xerox printer.



The Filmac 200 reader-printer makes enlarged prints up to 18x24 in seconds.

lining the advantages to be gained by such a system, was presented to management.

Here are some of the advantages noted by the committee in its second report to management.

A substantial savings in operating costs and in floor space was immediately apparent. The reduction in storage indicated a savings of 10,500 square feet, valued at \$25,000 per year.

The expenses for drafting supplies would be reduced by substituting paper for the linen then being used in drafting departments. A savings of \$48,000 per year was possible.

Another major item was an annual saving of \$125,000 in operating costs for the reproduction department.

Overall, the estimate of long-range savings amounted to \$360,000 annually.

Many other advantages

From a systems standpoint, there were other advantages. The microfilm intermediate provides continued availability of the drawing while the tracings are out of file for revisions.

The time cycle of print distribution is greatly reduced and thus provides better print service. Compared with the standard cumbersome operation associated with the pulling and refiling of full-sized tracings, the aperture card system has far more flexibility and reduces handling time.

The coding of aperture cards by product and type of assembly furnishes flexibility reference lacking in other methods. Until the aperture card was introduced, engineers, draftsmen, tool designers and other technical personnel maintained "black books" and other personal records, in which were notations about previous design, supersedures and matters of that nature. With the aperture card, it is relatively simple to find information of this sort through the codes pre-punched into the cards.

How the system works

Here is the system which was installed at the East Pittsburgh Division.

Original engineering drawings are now made on paper instead of linen. This change is practical since the handling of these tracings is now kept to a minimum. In fact, the tracing after it has been completed and approved in the Engineering Department is used for only one purpose . . . to prepare the aperture card.

The automated system begins with the original engineering tracings. They are arranged by size, listed and sent in groups to the reproduction department.

Two exposures are made of each tracing. The camera used is a Model C-3 Microfilm Camera of the Recordak Corporation.

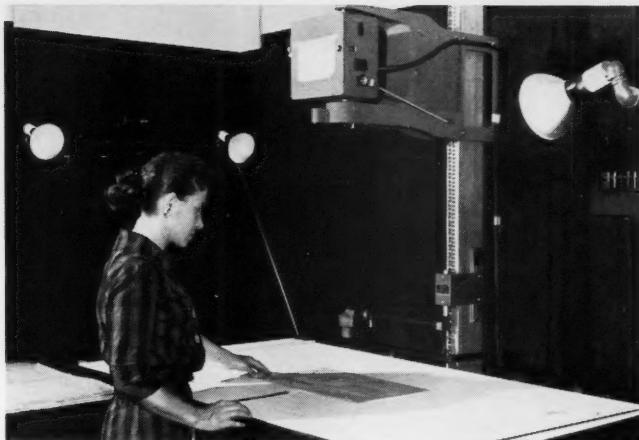
After the tracings are photographed, they are returned to the vault. They remain in the vault and are never used again unless it is necessary to change the original drawing. Then at the request of the engineering department, the tracing is removed from the vault, altered and re-entered in the microfilming procedure.

The engineering drawing list, made prior to filming, is forwarded to the IBM keypunch section where the Filmsort aperture card is prepared. Punched into this card are the drawing number, subnumber, date, microfilm roll number, product code, etc. One of the punched cards is illustrated on page 53. A second card is duplicated for each drawing on the list.

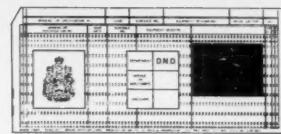
The processed film and the aperture cards are brought together at the mounting station. They use the semiautomatic Filmsort optical mounter to mount with precision the microfilmed image within the aperture. In addition, the optical screen of the mounter helps verify that the drawing number punched in the card corresponds with that of the microfilmed frame. The operator, as the films are mounted, separates the cards into two decks.

The duplicate deck is sorted by product code and sent to the engineering departments concerned. Original cards are forwarded to the master file where they are filed in drawing number sequence. To make this filing operation more efficient, aperture cards for the master file are generally sorted by machine into drawing number sequence and then interfiled by hand.

In addition to using Filmsort aperture cards for print distribution, Westinghouse maintains a second set



The only times a tracing is handled are when it is photographed on this microfilm camera arrangement.



It is reliably reported that the Canadian Department of National Defence will soon be specifying that all drawings submitted to it shall be in the form of aperture cards. Above is shown the official card selected by the department.

All companies bidding on tenders or supplying equipment to the DND will be required to conform, once the edict is made official. And once the DND adopts this system, the other departments should soon follow suit, in the race for economy.

of aperture cards for on-the-spot reference in its design and drafting section.

With the second set of cards, Westinghouse substituted two file cabinets of aperture cards for 65 file cabinets of prints. With aperture cards, engineers get a look or a copy from a Filmac 200 Reader-Printer, a product of Minnesota Mining and Manufacturing Company.

Master file kept intact

Westinghouse never releases any master aperture card from its files. As a result, the engineering file is always intact. Furthermore, print chargeout systems are eliminated since the copy from the Reader-Printer is a disposable one.

Reader-Printer copies help speed engineering changes. Sections of a Reader-Printer copy can be ink eradicated. New material can be sketched in these portions of the copy to give the draftsmen change instructions.

In addition, there is another form of output from this system which is proving itself more and more useful daily. For reference purposes where a drawing is needed to check a dimension, review a bill of material or verify a process or detail, Westinghouse are encouraging the use of microfilm reader. The drafting departments are equipped with such viewers, with magnification ratio of sixteen. Since each of the engineering departments has a duplicate aperture file by its product code, engineers use this duplicate file as an individual reference file.

When a draftsman or engineer needs to refer to a drawing, he goes to the card file, selects the desired aperture card and returns to his desk. By inserting the card into a reader, the draftsman has the drawing projected before him. Instead of shuffling large sheets of paper back and forth, the draftsman removes one aperture card from the reader and inserts another.

Since the cost of the Duplicard is a good deal less than that of a full-size print, Westinghouse are encouraging other office and shop locations to use viewers for reference. For example, a full-sized print of a 24x30 drawing from standard reproduction machines costs 18

cents. The cost of making a copy of the aperture card onto a Duplicard is only 5 cents. The same ratio of economy prevails in the case of smaller drawings.

What of the future?

In the not too distant future, it appears that the aperture card will be so well accepted throughout industry that, instead of furnishing full-sized copies of engineering drawings to customers, subcontractors, etc., standard practice will use aperture cards with microfilmed engineering drawings.

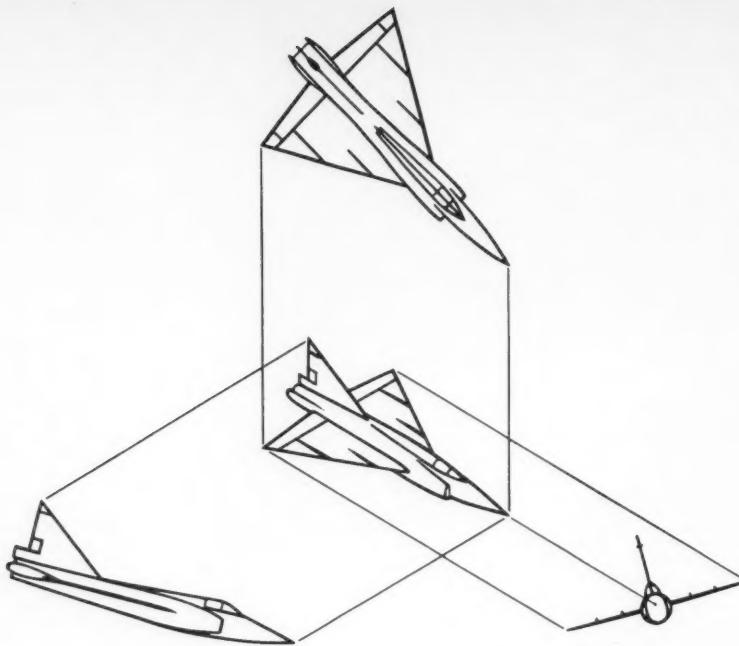
Today, government agencies require suppliers to send copies of engineering drawings in the form of aperture cards. In that connection, the aperture size selected by Westinghouse is considered the U.S. military standard. With a standardized size and location, drawings mounted on aperture cards can be freely exchanged throughout industry and the military organizations.

Those of you who have dealt with the government can calculate the savings by substituting a limited number of aperture cards in place of the usual fifteen or more copies of drawings now required. The savings will come not only from a reduction in paper and reproduction costs, but also in folding, packaging, and mailing costs.

The savings are many

The first areas of savings are in the handling and reproduction of engineering drawings. Obviously, as industry gains more experience in the automated techniques of drawing handling and reproduction, they should expect to find new ways of using both the tabulated data and microfilm picture in the aperture cards.

Westinghouse has found the pioneer concept of "working" microfilm to be stimulating and highly profitable. Though the East Pittsburgh Division represents one of the larger industrial organizations, it must be emphasized that the advantages of "working" microfilm are available to small firms as well. The capital investment necessary to gain these advantages is in proportion to the activity and volume in a given operation. Proper equipment is available in a price range compatible to the small user. *



Top, front, side and isometric views drawn the "united" way

A new drawing system makes its bow

At last—a direct method of drawing between views and a faster, automatic system for isometrics—as developed by Professor Wayne L. Shick of the University of Illinois

Engineers and scientists often ask, "Is there a better way?"

Positive answers to the question have been made by men in engineering graphics. Standards, nomography, photography, geometry, instruments, models and other items have been improved.

However, basic drawing methods have not been changed. These fundamentals have remained constant: (1) Method of measurement-transfer between orthographic views, (2) Method of isometric drawing, (3) Arrangement of views, and (4) Basic drawing instruments.

Perhaps there is a better way. A new basic drawing system is proposed which would change these four items. It is a truly "direct" method. "Direct" means "projecting between two views of a point with only one position of an instrument."

Measurement transfer between orthographic views

In traditional drawing, front and side views are in direct projection by means of the horizontal edge of a T-square or drafting machine. Similarly, front and top views are in direct projection along the vertical edge of a triangle or drafting machine. But top and

side views are **not** in direct projection; any means, whether dividers, scale, marking strip, miter line or arcs, requires more than one position of an instrument for each transfer.

This indirect process produces errors of significant magnitude and frequency and requires twice as much time to perform as a direct process. Time required and errors committed in depth measurement are an economic loss. Extra caution — at dollars-per-hour — reduces such errors, but can never eliminate them.

In the new drawing system, there is a direct projection between top and side views, as well as between front and side, and between front and top views. Depth, width and height — three basic dimensions — can be transferred **directly** between the three basic views — top, front and side. For a three-view drawing, one third of the measurement-transfers can be made in one half the time and with twice the precision by using the new drawing system instead of traditional means. This reduction of time and error in drawing will be an economic gain for industry and for engineering education.

Since World War II, drawing texts have presented direct isometric projection. In 1942, Professor Hoelscher discovered Eckhart's article, and presented "A

New Method of Axonometric Projection". This paper was of such importance that it was published in full in both the Journal of Engineering Education and the Journal of Engineering Graphics.

Professor Schmid and others published complete work on axonometry forty years ago — in Europe. European schools have taught axonometry for a long time. It has been virtually unknown in the United States and Canada. Why has it not been generally taught in basic drawing courses?

Isometric drawing

Isometric projection is direct, much faster and more accurate than isometric drawing. But there have been difficulties in preparing for isometric projection: (1) Necessary orthographic views have been conventionally drawn; (2) Orthographic views have been cut apart and carefully taped down at required angles; (3) With the views taped in position for isometric projection, plotting more points in the orthographic views has been tedious and inexact.

Using the new drawing system, orthographic views are presented ready for immediate isometric projection. There is no cutting out, no careful positioning, and no taping down of views. Additional points can be found directly without error or loss of time. All objections to isometric projection are removed.

With the new system, isometric projection is direct from the orthographic views. The projected isometric is a triple check on orthographic precision. Isometric and orthographic are directly integrated. Tests between traditional isometric drawing and isometric projection demonstrate a time-saving of 25 to 40% and increased precision by using the new system.

Is there a better way? A more precise isometric can be drawn in much less time.

Arrangement of views

Traditional arrangement of views presents no difficulty in interpreting width and height dimensions. But depth measurements are not easy to read between top view and side view. Further, in reading between isometric drawing and orthographic views there is no direct projection, no direct correlation.

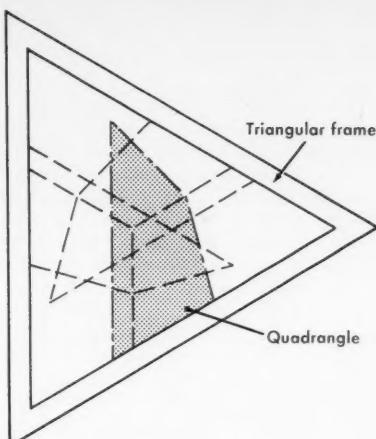
The new system has equal offset between top, front and side views. For drafting, checking or reading purposes, the instrument registers directly between any two views of a point, whether orthographic or isometric. Direct correlation of orthographic and isometric views facilitates clear interpretation. Rapid, unmistakable communication effects cumulative savings in the work of the draftsman, engineer, machinist, administrator and customer, with each use of a united orthographic-isometric drawing.

Basic drawing instruments

The traditional drawing instruments have been T-square and triangle or drafting machine. Incidental tools are also used, such as circle and ellipse guides, scale, compass, etc.

Other than incidental pieces, the new system has one moving part, a plastic quadrangle. With quadrangle in one hand and pencil in the other, there is freedom and mobility. Measurements are precisely and directly transferred between orthographic views, and between orthographic views and isometric view. Line work is rapid and accurate. For controlled freehand sketches or for precision drawings, orthographic or isometric, the instrument is ideal.

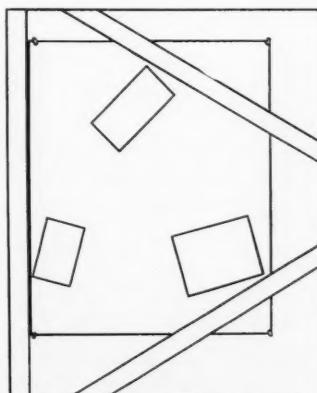
Here's how it's done



The equipment for the new drawing method consists of two parts: a quadrangle and an equilateral triangular frame. The quadrangle can be manufactured by the same processes as a conventional setsquare. The interior angles are 45, 60, 150 and 105 degrees. The triangular frame can be one piece or three demountable pieces.

The triangular frame is placed in the desired location over a drawing of any size. The quadrangle slides along each of the three sides of the interior of the frame. This permits direct projections between all four standard views: top, front, right side and isometric. Projections are made without transfer lines or error — this is truly direct projection.

Any other principal orthographic views which are desired (such as underside, rear, left side) and their associated isometric view can be easily projected by turning over the drawing and repositioning the frame. A light-table and good quality tracing paper (with optimum transparency) facilitate the drawing of such additional views.



The relative position of the three conventional views of a rectangular block by the new drafting method.

Preferred numbers are series of numbers selected to be used for standardization purposes in preference to any other numbers. Their use leads to simplified design practice and they should be employed whenever possible for individual standard sizes and ratings, or for a series thereof.

The sizes of a manufactured product are generally determined with a view to utility or appearance. The designer generally has a great deal of freedom in the choice of sizes. Even in those cases where size must be determined on the basis of utility alone, they are often permitted to vary within wide limits. In the absence of any guidance as to what values should preferably be used, the sizes chosen by different designers usually shows a wide spread. As a result the trend is often away from such uniformity of sizes as would be advantageous as well as practicable.

It is here that the use of preferred sizes plays its most important role. The adoption of a series of preferred numbers to be used by all designers, as the term indicates, **in preference to all other sizes**, tends to unify sizes chosen by different designers, and to create a uniformity and interchangeability which are often indispensable to successful industrial operation. This feature is particularly important in Canada, where small lots and short runs are standard.

What is this system?

Actually, the system of preferred numbers is a very simple one. Preferred numbers have been developed in various series where the numbers have been selected to have definite relations to one another.

These series are based on geometrical series. Using 10 as the first number of a series, the other theoretically exact numbers of any series are obtained by multiplying, or dividing, the first number by the constant factor applying to the particular series and repeating this operation with each resultant number. These factors are established as follows:

For the 5 series $5\sqrt{10}$, or 1.5849

For the 10 series $10\sqrt{10}$, or 1.2589

For the 20 series $20\sqrt{10}$, or 1.1220, etc.

The formation of the various series may be accomplished also by starting with the 40 series and taking every second number to form the 20 series; every fourth number to form the 10 series and every eighth number for the 5 series.

The different series of numbers, including the Basic Preferred Numbers in both decimal and fractional form, and a supplementary series, are all detailed in Z17.1-1958 standard issued by the American Standards Association.

How do we use preferred numbers?

Preferred numbers are one of the easiest tools the designer can use to assist him in making major size decisions. Unfortunately, the average designer in Canada appears to have not yet heard of the term, let alone applied its principles.

Engineers who have had specialized training in standards generally make frequent use of these series. Stocks of component parts, such as hardware, fasteners and bearings, should be based on preferred numbers. Sizes of wire, thicknesses of materials, and other materials stocking problems are easily answered by the application of these principles.

In planning new designs, whether they be for component parts or the overall marketed product, engineers should use preferred numbers whenever possible.

Here is a system in which all designers would use uniform sizes.

It would create the interchangeability needed for successful standardization.

Preferred numbers

Their use in the design of complete machines, for instance, results in maximum interchangeability to the user and also facilitates a comparison of the products of different manufacturers. This means that they should be applied primarily to the commercial ratings most commonly used, such as horsepower, speeds, etc. They should also be applied to important overall and mounting dimensions. Finally, the individual designer will find it convenient to apply preferred numbers to characteristic dimensions, ratings, etc., that will facilitate standardization within his own sphere of activity.

In the standardization of parts of apparatus, interchangeability is often the prime consideration. This can be facilitated by the use of preferred numbers for sizes and dimensions. Possible applications to materials and hardware are innumerable. If both raw material and finished dimensions are involved, preferred numbers should first be applied to the finished dimensions, and then to the raw materials, but only if this can be done without economic waste.

History of development

A table of preferred numbers, recommended to industry for a period of trial, was formally approved and published by the American Standards Association in 1927. In 1931 the subject was given additional study by a sectional committee of the ASA. Working in collaboration with the International Organization of Standardization (ISO), the present standard was first promulgated and issued as an ISO Guide to the Use of Preferred Numbers.

In 1934 the first draft of a proposed American standard was published for general criticism and comment, and was approved in 1936. The 1958 revision of the standard made one very significant major change — all references to inch dimensions were deleted, thus confining the standard to abstract numbers. The application of these pure numbers to specific practical systems is thus made the responsibility of those active in each particular field of application.

The application of preferred numbers as a continuing program is, however, the responsibility of every engineer, whether he be involved in design, standards or production. We suggest you secure a copy of ASA Z17.1-1958 and acquaint yourself with the full potential of this numerical concept.

This report has been condensed from ASA Standard Z17.1 — 1958 which was sponsored by the American Institute of Electrical Engineers.

$$\begin{aligned}
 & \sqrt[5]{10}, \text{ or } 1.5849 \quad \frac{1}{4} \quad \frac{15}{64} \quad \frac{21}{32} \quad \frac{3}{8} \quad \frac{23}{32} \\
 & \sqrt[10]{10}, \text{ or } 1.2589 \quad \frac{9}{16} \quad \frac{7}{8} \quad \frac{9}{32} \quad \frac{11}{16} \quad \frac{1}{2} \\
 & \sqrt[20]{10}, \text{ or } 1.1220 \quad \frac{19}{32} \quad \frac{5}{8} \quad \frac{13}{16} \quad \frac{3}{4} \quad \frac{17}{64}
 \end{aligned}$$

simplify design size decisions

BASIC PREFERRED NUMBERS—FRACTIONAL SERIES ($\frac{1}{8}$ to 40)

The use of Preferred Numbers in binary fractions should be restricted to cases where such fractions are in common use and decimal fractions are therefore impractical. Percentage figures in headings are approximate averages.

$\frac{1}{8}$ to 1				1 to 10				10 to 40			
5-Series (60% Steps)	10-Series (25% Steps)	20-Series (12% Steps)	40-Series (6% Steps)	5-Series (60% Steps)	10-Series (25% Steps)	20-Series (12% Steps)	40-Series (6% Steps)	5-Series (60% Steps)	10-Series (25% Steps)	20-Series (12% Steps)	40-Series (6% Steps)
				1	1	1	1	10	10	10	10
	$\frac{1}{8}$	$\frac{1}{8}$				$1\frac{1}{8}$	$1\frac{1}{8}$			11	$10\frac{1}{2}$
		$\frac{9}{64}$				$1\frac{1}{4}$	$1\frac{1}{4}$			12	$11\frac{1}{2}$
							$1\frac{3}{8}$			13	12
							$1\frac{3}{8}$			14	13
							$1\frac{7}{16}$			15	14
$\frac{5}{32}$	$\frac{5}{32}$	$\frac{5}{32}$		$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	16	16	16	16
		$\frac{11}{64}$					$1\frac{3}{4}$			17	17
		$\frac{3}{16}$	$\frac{3}{16}$			2	2			18	18
			$\frac{7}{32}$				$2\frac{1}{4}$			19	19
			$\frac{7}{32}$				$2\frac{1}{4}$			20	20
			$\frac{11}{64}$				$2\frac{9}{8}$			21	21
$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$2\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{2}$	24	24	24	24
			$\frac{9}{32}$				$2\frac{3}{4}$			26	26
			$\frac{11}{32}$			3	3			28	28
			$\frac{5}{16}$				3			30	30
			$\frac{11}{32}$				$3\frac{1}{2}$			32	32
			$\frac{23}{64}$				$3\frac{3}{4}$			34	34
							$3\frac{1}{2}$			36	36
							$3\frac{3}{4}$			38	38
$\frac{3}{8}$	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{3}{8}$	4	4	4	4	40	40	40	40
			$\frac{7}{16}$				$4\frac{1}{2}$				
			$\frac{15}{32}$				$4\frac{1}{2}$				
			$\frac{1}{2}$			5	5				
			$\frac{9}{16}$				$5\frac{1}{2}$				
			$\frac{19}{32}$				$5\frac{1}{2}$				
$\frac{5}{8}$	$\frac{5}{8}$	$\frac{5}{8}$	$\frac{5}{8}$	6	6	6	6				
			$\frac{11}{16}$				6				
			$\frac{23}{32}$				$6\frac{1}{2}$				
			$\frac{3}{4}$			8	8				
			$\frac{7}{8}$				8				
			$\frac{15}{16}$				$8\frac{1}{2}$				
			$\frac{15}{16}$				9				
			$\frac{15}{16}$				$9\frac{1}{2}$				

Above 40 the fractional Preferred Numbers are the same as the decimal Preferred Numbers.

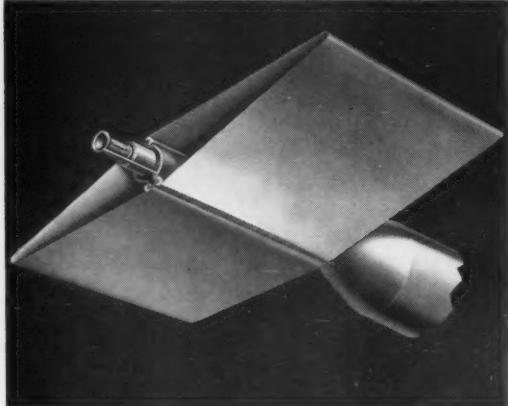
Below $\frac{1}{8}$ the decimal series should be used.

Below $\frac{3}{16}$ the steps of the 40-series are omitted, as gradations finer than that of the 20-series will seldom be used.

In order to make the fractional system conform to well-established practices, the selected figures do not conform as closely to the theoretical values as the figures in the decimal system, the discrepancy being as much as 4 to 6% in some cases. The maximum difference between values of the decimal and corresponding fractional system is 6.3%.

Designnews

in pictures



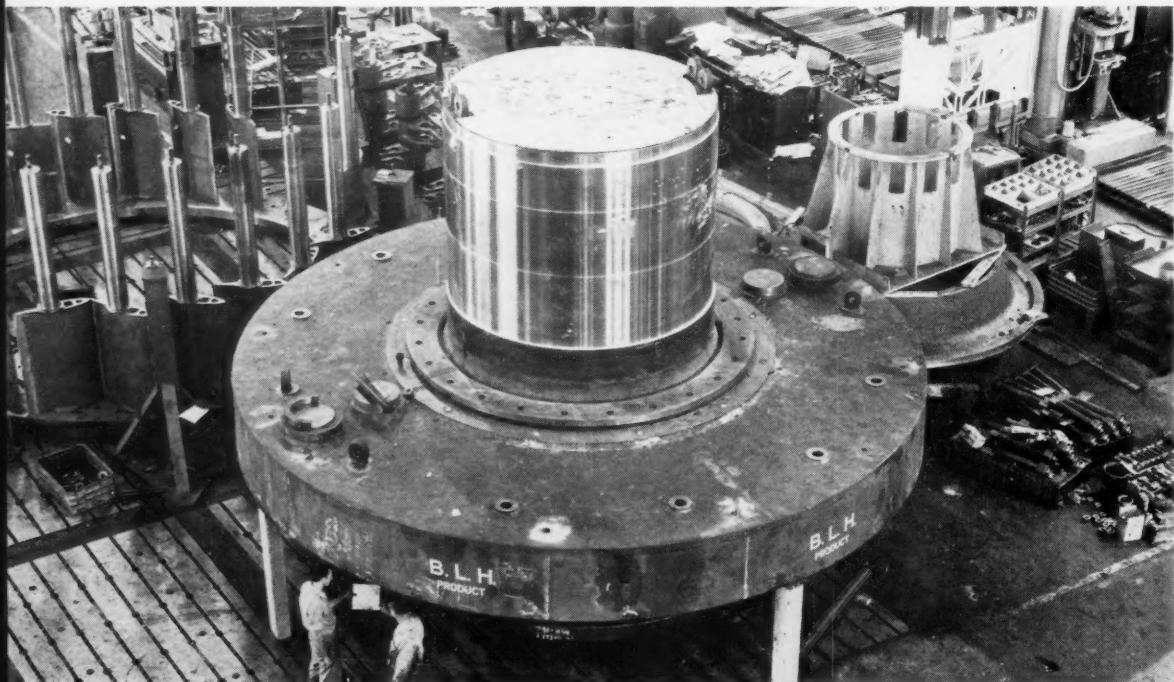
Artist's drawing of moving belt radiator for earth satellites and interplanetary space vehicles. Radiator is much lighter than the proposed tube and fin type. It can continue to operate even if punctured by meteoroids in space.



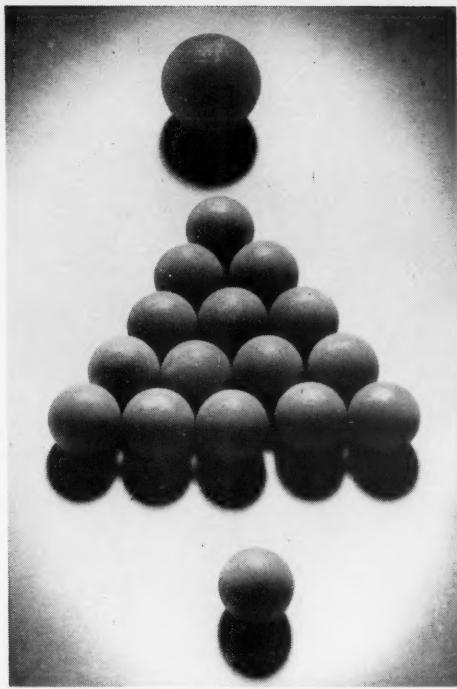
For the first time stainless steel wire has been given an electroplated brass finish to combine the good adhesion of brass to rubber with the corrosion resistance of stainless.



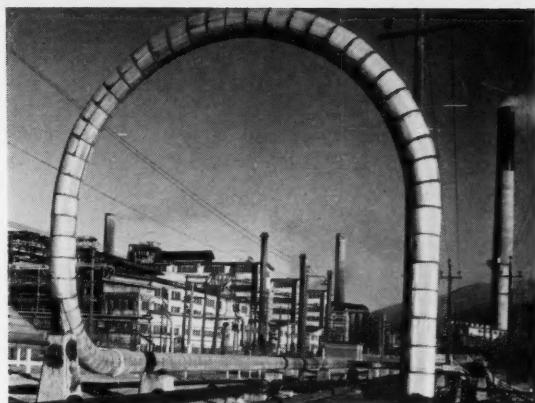
No, it's not a bird's nest, though it does go aloft. It's copper chaff and the U. S. Navy rockets it skywards to track its descent by radar. It's all done in the interests of weather forecasting.



This 286 ton main pintle assembly is part of a mammoth 600 ft. diameter radio telescope for the U. S. Navy. The assembly includes a 115 ton shaft, 175 ton base and 6 ton flanged wedge ring. The entire structure will weigh 8,000 tons.



Not cannon balls, not billiard balls, but solid Teflon spheres used as spacer or filler material to maintain a specified volume of liquid in a container.



One third of Canada's sulphuric acid comes from the plant framed in this steam line expansion loop. It's the Consolidated Mining & Smelting Co. plant at Trail, B.C.



There are no spills when these five-gallon pails ascend a 60-degree incline because magnetic rails under the conveyor belt hold them securely.



The 65-ton reactor vessel is lowered in place at a 75,000 kw nuclear plant near Hallam, Neb. The vessel is 33 ft. high and 19 ft. in diameter.



Winter's still with us, but it's less of a problem if we keep walks and driveways clear with this snow thrower. For easy operation the engine is over the rear wheels and the thrower is on sled-like skids.



The smallest model in GM Diesel's "Blue Goose" range. Known as the GMD H-3, this lightweight diesel-hydraulic locomotive has a gross hp rating of 275 continuous total output from the engine.

George Harry
Assistant Editor

A design profile

Will the Blue Goose win world markets?

Its remarkable design features were expected to bring large sales abroad, but not a single unit has yet been sold. The problem is dollars and fortunately the situation is expected to improve soon.

The visitor from overseas, impressed by the vastness of everything in Canada — from spaces that are wide open to steaks that are two inches thick — may get a surprise if he should chance to visit a plant in London, Ont.

Having been conditioned to locomotives on the same magnificent scale as the sundaes, the newspapers and everything else in this country, he

will be confronted with a series of locomotives so small that they would look lilliputian even alongside the small railway engines in his own country.

Let's reassure our visitor at once. These locomotives, designed in Canada and built at the General Motors Diesel Ltd. plant in London, are not destined for the Canadian market.

They are intended for export to a particular type of market loosely designated as the do-it-yourself market.

These small diesel-hydraulic locomotives (the smallest is only 22 feet from front-end sill to rear-end sill) incorporate several design features which permit the use of that overworked word "unique"; features such as the knock-down construction and the swing-out controller.

Knock-down construction simplifies shipment. The larger model knocks down into six major components, reducing cubic content and freight costs. But there are two other advantages which far transcend shipping convenience.

First of all, the local manufacturer

is in a position to assemble locomotives to meet specific customer requirements in spite of infinite varieties in axle load, track gauge, wheel arrangement, clearance restrictions, etc. In other words, the locomotive combines custom-built and off-the-shelf convenience.

In passing, what is this reference to the local manufacturer? Well, General Motors recognized many years ago that to do business in world markets it is necessary to set up plants abroad or make licensing arrangements with foreign manufacturers; in both cases local manpower and materials can be used. The same flexible policy applies to these small diesel-hydraulic locomotives, which the local manufacturer can build in part as desired.

The second advantage is that in the event of damage, or if the locomotive needs a major overhaul, the assembly involved can be removed and replaced with an alternate component. It can either be overhauled locally or rebuilt by a GM dealer anywhere in the world. Or another possibility, the customer can order a unit exchange component from GM Diesel in advance of his requirements; the replaced assembly is returned to Canada and the customer receives a credit for useable material.

Controller swings out

The other interesting design feature is the swing-out controller. This simply means that the control equipment can be swung either to the left or right side of the cab to suit a single operator. This feature makes a single-control locomotive dual controlled; in other words, it gives the locomotive driving controls on both sides of the cab.

There are more design ideas in this locomotive, though not all are unique. For instance, there is glass fibre reinforced plastic in the cab roof and in the intricately shaped nose sections; nowadays plastics are being freely applied to much of these equipment in the transportation field. Plastic's seamless construction, one-piece moldings, flowing lines and compound curvatures mean a new kind of freedom which the designer has been quick to seize. In low-volume production runs the use of plastics is often much more economical than alternative materials.

Unfortunately, General Motors Diesel received something of a setback in their use of plastics. Originally the reinforced synthetic was used in the entire hood sections, which had been designed with many compound curves, but the designers ran into cost and fitting problems and had to turn to the conventional materials.

The locomotive comes in two models, one designated GMD H-1 and the other GMD H-3. No. 3 is the smaller model, with a gross rating of 275 hp continuous total output from the engine, including power for propulsion and auxiliaries. No. 1's rating is 550 hp, but even this is low power compared with the 1,750 hp units on Canadian tracks.

However, these lightweights offer horsepower options, the smaller model to 400 hp, and the larger to 800. Also (and here's another interesting design feature) multiple control equipment permits two or more units to be operated from one cab. Thus, three model GMD H-1 units rated at 800 hp each provide 2,400 gross locomotive hp, equal to the biggest locomotives on today's railroad tracks.

Why no sales?

Known locally as the "Blue Goose", a name which GM Diesel's design engineers detest and cannot explain, the locomotive is available in gauges from 3 ft to 5 ft 6 in., a range that takes in most tracks in the world.

In view of its versatility, its unusual design feature and its competitive price, it might be assumed that the Blue Goose has won a big market in many parts of the world. Alas, this is a false assumption.

Not a single model has yet been sold, though the designers began work on the project as long ago as 1955 and the prototype was completed in 1956 (in which year it was displayed at General Motors Motorama in Toronto).

The lack of sales, as E. V. Rippington, Jr., GM Diesel's president and general manager, is quick to point out, is no reflection on the locomotive, but only a symptom of the problem of long-term financing in the very countries where it is hoped to sell the Blue Goose.

One of the five Blue Goose units extant is now in Brazil and GM sales personnel are in South America as well as other areas of the world. From these efforts the company confidently hopes for early sales. The remaining four locomotives are in London, Ontario.

Mr. Rippington estimates the potential market for the Blue Goose at 15,000 to 20,000 units. This figure is possible now, he says, because we have overcome the "horrible image" of earlier diesel-hydraulics and because we in Canada enjoy an advantage in efficiency, quality and reliability. All we need now to swing some sales is an advantage in financing.

The Blue Goose is strictly Mr. Rippington's baby. He conceived it one



The swing-out controller, a unique design feature, allows the engineer to swing the control equipment to either the left (as shown) or right side as desired.

day while driving a Euclid tractor in Cleveland, Ohio. By some thought transference which is no longer too clear, that tough, rugged vehicle got him thinking about a locomotive which could be shipped to any part of the world in building block style, even, as he puts it, to the shores of the Zambezi.

Something else that got him thinking of building block style was the recognition of the fervent nationalism in many parts of the world. He felt that locomotives which offered opportunity for local assembly would be more acceptable in many such markets than locomotives already assembled.

If the buyer elected to build the underframe himself, Mr. Rippington reasoned, he could buy just the two power units, the trucks and the cab, thus saving some of his hard-earned currency. Or he could also fabricate the truck assembly or other components if he wished. Mr. Rippington was willing to supply anything from a complete locomotive to a minimum of engines, transmissions, gear boxes and controller.

The Blue Goose is almost entirely Canadian. Only the engine and transmission come from the United States. Ironically enough, its very Canadianism has hindered its sale, since if it were US-made it could have been financed by the Import-Export Bank.

However, new methods of long-term financing, recently announced by the Canadian government, have greatly enhanced the immediate prospects for sales.

Meanwhile, Mr. Rippington is confident that his baby will soon join the nearly 25,000 GM locomotives in operation in many parts of the world, including the Americas, Europe, Asia, the Near East and Africa. It's just a matter of time before its design versatility wins universal recognition. ★

Design Engineering opinion poll

What should Canadians do to increase exports?

Henry E. Strub
Co-ordinator of design
Aluminum Secretariat Ltd.
Montreal



The Canadian manufacturer's ears must be ringing with all the admonitions he has received in recent months to produce more for less and then get out and sell it abroad. Little has been said about what he should produce and for whom. Is it assumed that he knows all about this? If he does, why is there a problem? Exports begin at home. If Canadian industry can produce things that people need and want here and if they can successfully meet the competition on the home field, they have the indication that the product is ready to sell abroad.

The Canadian public is not identical with the American public, or any other public for that matter, and if the Canadian manufacturer can produce something of special appeal for his own public, he will find people all the way from Alaska to Vladivostok (going the long way around) who have similar climatic conditions, similar problems and perhaps similar tastes and who will therefore buy from him. What the manufacturer must do is employ designers who will assist him in producing merchandise to meet this demand.

So much for the Canadian manufacturer who all too frequently already has guilt feelings about the designs he pirates from abroad.

Canadians are also found in government in Ottawa. Mr. Hees has successfully demonstrated that manufacturers were astonished and that the public was amazed at the response by industry generally to his recalling 111 trade commissioners from their posts all over the world in order to talk to 1,100 manufacturers.

For one reason or another almost everything about the outside world seemed to be news to many of the businessmen who went on that particular pilgrimage to Ottawa. Too few of them have reliable representation in markets abroad. Mr. Hees' move was surely therefore a step in the right direction.

One of the chief obstacles to the export of manufactured goods is the temperamental nature of the customs departments of other nations. The passage of Canadian goods across the border is often impeded and delayed needlessly at the border. Ottawa can help by insisting on reasonable treatment of Canadian merchandise in countries from which we buy.

All in all, in this matter of exports we are our own worst enemy. We still tolerate meaningless bleating in public to the effect that we are a young country and that we are a small country and these, together with all the other clichés, form a conspiracy of inferiority that prevents us from seeing ourselves as we really are.

Once again this month readers preferred to remain inarticulate on an issue of vital concern to design engineers. We had hoped they would respond readily to an invitation to express their views on exports, since Canada's export trade is dependent on the ingenuity of our engineers. As it happens, only a couple of outstanding designers went to the trouble of answering. The remaining views came from top management and association spokesmen.

Henry Finkel, ACID,
Finkel/Everleigh Designs
Montreal



We can increase exports by making the best possible product in the most efficient way, industrially, economically and contemporaneously.

The history of successful world merchandising points to two fundamental factors: price and/or value. Canada's high-level economy can hardly permit a price advantage where labor is an important part of product cost. Canada's excellent position as an exporter of primary materials—basic foodstuffs, metal ores and ingots—are simply the result of having a good supply at acceptable grade, conveniently available.

Canada's secondary industry can only increase exports for its product by building into it those unique qualities that will set it apart from all other similar goods made anywhere. This is not just an idealistic fantasy.

The British Empire thrived on the product slogan "British is best." Scandinavian furniture and furnishings sell well here because of appealing quality, price notwithstanding. The Volkswagen has its own world niche because of its advantages over any other car. Canadian farm machinery sells across our borders because it is conspicuously better than its competitors.

In fact, a nation's association with its best known product has become a cliché: Swiss watches, French wine, German machinery, Italian typewriters, Danish furniture, British woollens, Dutch cheese, Canadian rye,

Czech glass, Spanish lace, Indian silk, Japanese cameras . . .

Value is the answer. Good materials, sensible construction and manufacture, and that elusive ingredient, "being and looking just right", all properly designed into the product, will open the world to the aggressive Canadian producer.



Lionel C. Bosanquet
President
Canadian Importers &
Traders Association

One of the things that impresses me most about the activities of our overseas suppliers is the care they take to ensure that the products they have for sale are properly introduced to the Canadian buyer, and furthermore that what they have to offer is suitable as to quality and design for this market.

In my view the most important step toward increasing our exports must be to take an example from the practice of these overseas suppliers and be sure, by adequate market research, that the products we wish to sell are properly designed to suit the taste of the consumers in the overseas market. Care must also be taken that the deliveries we can promise are in line with any seasonal requirements of the market concerned and that the price is competitive with other overseas suppliers for similar qualities.

Finally, we must bear in mind that, generally speaking, countries cannot buy from us unless we are importing products from them and that for this reason any restriction imposed on the import trade of Canada is bound to have an adverse effect on the possibility of increasing our exports. For this reason it is important to ensure that as far as possible the ability of overseas manufacturers to sell in this market should not be impeded by restrictive legislation.



T. R. McLagan, OBE
President
Canadian Mfrs. Association

Responsibility for bringing about a substantial annual increase in Canada's exports is essentially a team task involving industry, labor and government.

So far as industry is concerned, it means aggressive international salesmanship. This is of particular importance where our manufactured goods are concerned, since it is in this field, as distinct from primary products, that we are experiencing the most intensive competition, not only from the United States and Britain,

but the war-damaged nations that have come back more strongly than ever, notably West Germany and Japan.

Our limited domestic market provides the strongest possible reason why Canadian manufacturers should seek to sell their wares in the markets of the world.

Although highly manufactured technical and consumer goods currently account for but roughly 15% of our total exports, their high labor content means that their impact on employment is substantial. Obviously then, the more we can sell abroad, the more jobs there will be for Canadians.

Price, quality, delivery and service — these are the paramount factors governing sales abroad no less than at home. The value of our exports will be largely determined by the extent to which we are competitive under all these four headings.

Insofar as industrial management can influence them, it must obviously do so with all vigor and enterprise. But — and here is where the teamwork comes in — much also depends on labor and government.

This is the message which the Canadian Manufacturers' Association has long sought to convey to all Canadians. It welcomes recent signs that, at long last, there is a better appreciation that selling more of our manufactured goods abroad is not a job for management alone.

In a sentence, then, my answer to the question "What should Canadians do to increase exports?" is: Understand that this is a teamwork proposition calling for imagination and enterprise, self-discipline and incentive.



W. B. Elliott
Vice-president Manufacturing
E T F Tools Ltd.
St. Catharines, Ont.

In my opinion, the way to increase exports is:

1. Freeze wages, salaries and prices.
2. Depreciate the Canadian dollar substantially.
3. Reduce, substantially and by statute, the interest rates on "non-risk" investments.

4. Transfer the present armies of unemployment administrators to the Immigration Department.

Chronologically, item 4 should begin first as the influx from the U.S.A. would be immediate while the influx from other countries would, of necessity, be slower.

The reason for transferring the unemployment administrators from their present jobs is that they will have nothing to do. The reason for transferring them to the immigration department is that their experience best qualifies them to distinguish between immigrants likely to find a place in our economy and those likely to become charges on the public. The reason for first providing for an influx from the U.S. is entirely physical as it takes much less time to get from the U.S. to Canada than from Europe to Canada.

NEXT: There are fewer engineers than other professional men in public life. Do you think engineers should be more active?

Want product info in a hurry?

Microfilm system cuts searching time 90%

According to a recent survey, the average engineer spends 300 hours a year, or 15 per cent of his time, searching for product and specification data.

This searching time is cut to 10% with the use of a new microfilm catalogue file, according to claims made by its developers.

The system consists of a microfilm file, a reader and a photo copy device. The system is leased to user companies on an annual basis and its sponsors say that the cost is less than the annual salary of a file clerk.

So far only one edition has been published, for the missile and aircraft industry, where there was an acute need for fast and accurate information.

Two more editions will be published this year: for the automotive industry and for communications (manufacturers of radar, TV, data processing equipment, etc.). By next year the system will be available for three other industries: (1) electrical power and distribution equipment; (2) industrial machinery, and (3) electrical power and distribution equipment.

The system, known as VSMF, works as follows: The engineer searches an index for the material in which he is interested. This refers him to a reel of microfilm. He inserts the reel into a viewing machine and within 15 seconds can locate the page in which he is interested.

A magnified copy of the page appears on a TV-like screen and by means of a

photo-copy device the engineer can quickly make a picture of the page. The system also provides the name of the company that makes the product and the address of the nearest sales office.

Always Up-to-Date

Reels are revised every four months to keep the information up-to-date.

The edition now out contains more than 25,000 catalogue pages recorded on 22 reels of microfilm. As the system is developed, more pages will be added.

The system was developed by two firms, one connected with the publishing industry and the other a subsidiary of Eastman Kodak. It employs a new development in microfilm techniques, an automatic self-loading magazine which makes it unnecessary to handle the microfilm.

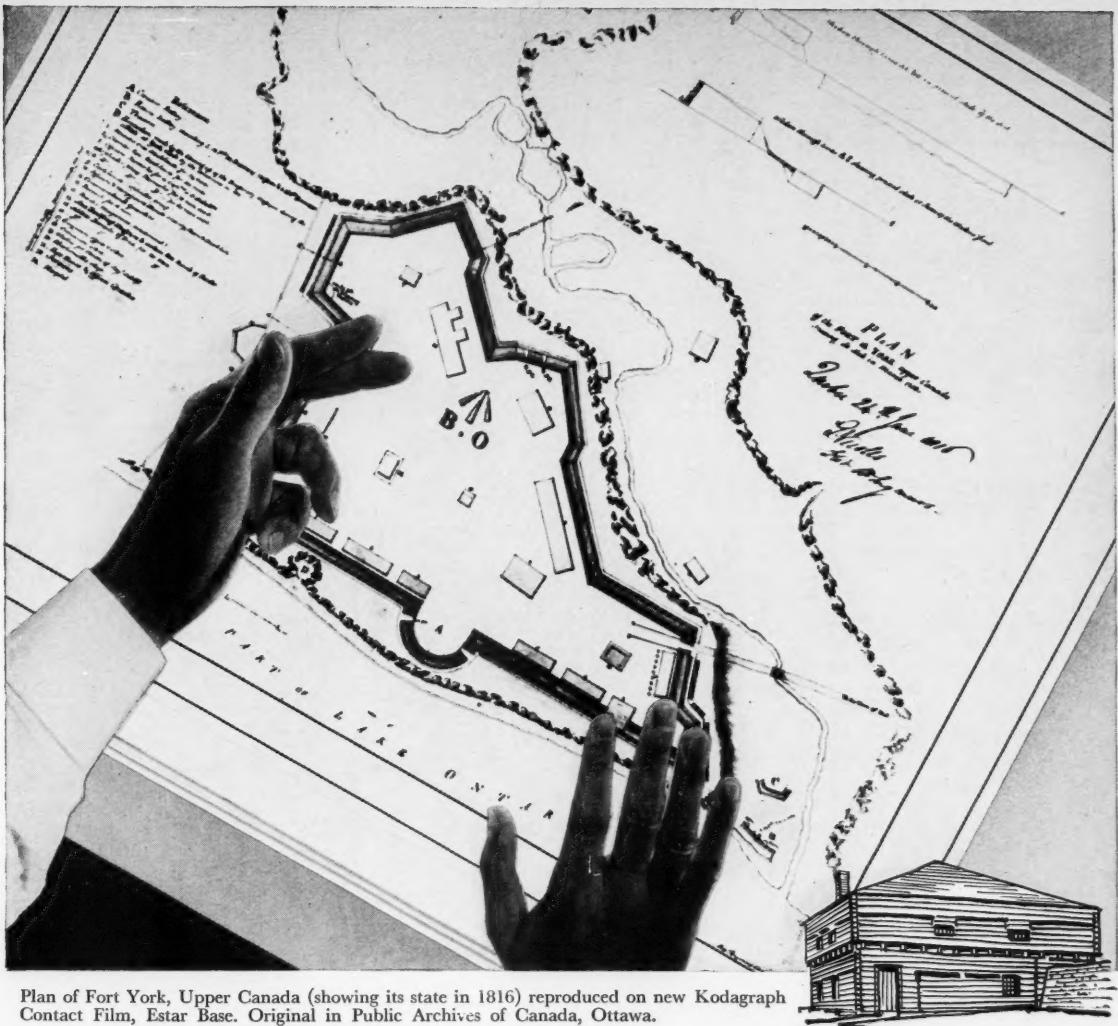
The sponsors claim the following advantages for their system over the conventional method of filing catalogues:

Four Advantages

1. The system eliminates human errors because the information cannot be removed from the file.
2. It eliminates long rows of filing cabinets for storing catalogues. In their place is an installation that requires less than five square feet of space.
3. It provides fast, accurate information.
4. It discourages firms from keeping private files of catalogues which are often out-of-date.



The contents of the big load of paper above are all contained in the tiny microfilm magazine the girl is holding. On the left is the complete system containing supply of microfilm magazines, the reader (or viewing magazine) and the photo copy device (which makes a picture of the page). The system supplies product information and specification data on the aircraft industry. Other editions to be published this year will cover the automotive and communications industries, and by next year the system will be available for three more industries.



Plan of Fort York, Upper Canada (showing its state in 1816) reproduced on new Kodagraph Contact Film, Estar Base. Original in Public Archives of Canada, Ottawa.

New way to restore old drawings!

New Kodagraph Contact Film, Estar Base, transforms old, soiled, or weak-lined drawings into top-quality intermediates which will stand up under punishment in print-making machines and on drafting boards.

Bound to be a favorite in darkroom as well as drafting room, this new Kodagraph Contact Film lets you produce same-size intermediates with new convenience. Simply expose with low-cost paper negative (or film negative) in standard contact printer. Process with either paper or litho developer. Exceptionally wide latitude — in exposure and development—all but ends make-overs.

See this new Kodagraph Film — and the others in the new Estar Base line: Kodagraph Autopositive Film, Kodagraph Projection Film.

All combine reliable Kodak emulsions on the new Estar Base — highly translucent, durable, and dimensionally stable, with excellent matte surface on both sides for easy drafting. Available in standard drawing sheet sizes and in rolls up to 52 inches wide. Call your local Kodagraph Dealer, or write Canadian Kodak Co., Limited, Toronto 15, Ontario.

NEW!

Kodagraph

REPRODUCTION FILMS

... for best line-for-line reproduction

Kodak
TRADEMARK

For further information mark No. 112 on Readers' Service Card

Overheard in Ottawa

Engineering firms plan export drives

Of the 1,400 businessmen who went to Ottawa for the recent Export Trade Promotion Conference, close to 40% represented engineering and consulting services or machine equipment industries. This suggests a big drive for machinery and equipment exports.

Many businessmen arrived with samples of equipment about which the trade commissioners had no knowledge. A typical example was a new process for making asbestos-cement blocks and slabs by drawing the material together with a vacuum, producing stronger wall and a smoother finish. This product is already being exported to Guatemala and trade officials see good prospects for export elsewhere.

Another item new to the trade commissioners was a food blending machine developed by two former Avro employees. Already exported to five countries, the blender cuts blending time on jams from three minutes to 20 seconds.

The engineers showed special interest in South America. Following the recent mission of consulting engineers to several South American countries, a group of construction engineers is flying down this month.

Deans help India

The External Affairs Department selected two deans of engineering to conduct an engineering survey for the Government of India as part of the Colombo Plan. The survey will investigate India's engineering needs in relation to the country's third five-year plan.

Dean R. R. McLaughlin of the University of Toronto and Dean H. G. Conn of Queen's left for New Delhi in January and are expected to be away two months.

Facts about small loans

Businessmen operating "small" enterprises can now get medium-term loans at interest rates slightly below the prevailing terms for improvements to buildings or the purchase of new equipment. Here are the answers to your questions:

What is a small businessman? Anyone whose gross business did not exceed \$250,000 during the year in which the application is made.

What kind of business qualifies? Those in manufacturing, service, wholesale and retail trade.

Who lends the money? Chartered banks.

How much? Anything up to \$25,000.

For what term? These are intermediate loans, not short-term working capital or long-term construction loans. The term depends on the borrower, but the maximum is 10 years.

What's the interest rate? The prevailing prime interest rate—now 5 1/4%—less an allowance to cover insurance against loss, since the government guarantees the loan. The allowance is expected to be one quarter of 1%, making the effective rate 5 1/2%.

How long will the program last? At present for three years.

How much is available? \$300 million spread over the three years.

RCN building subs

Watch for an announcement that the Royal Canadian Navy will build six submarines of the conventional type in the latest design. They will be used to diversify our anti-submarine forces and will cost between \$20 and \$30 million each.

The National Defense people are debating whether the subs should be built in one or two shipyards or at various points across the country. The latter course is better politically, but the navy prefers concentration.

Opportunities in Jamaica

Jamaica offers a new market for manufacturers of electrical appliances. Refrigerators, stoves, water heaters and washing machines, in that order, are in demand because of large-scale housing development and rising living standards.

C. G. Bullis, Assistant Trade Commissioner in Kingston, who furnishes this information, warns that price is a factor. For the first six months of 1960, U.S. refrigerator prices dropped between \$10 and \$15 per unit and their share of the new market rose substantially. Canadian prices remained static and so did our volume of business.

Probe plans

The Tariff Board will hold a public hearing on February 13 on engineers' and architects' plans, drawings and blueprints. Tariff items 180e and 180f were referred to the board last year by Finance Minister Fleming with a request that "consideration be given to clarifying the interpretation of these items," which "have given rise to problems relating to the rate of duty and determination of values for duty purposes."

LIST OF DEALERS

BRITISH COLUMBIA

Clarke & Stuart Co. Ltd.,
550 Seymour Street,
Vancouver, B.C.

Eldrico Geophysical Sales Ltd.,
633 Hornby St.,
Vancouver 1, B.C.

Frederick Goertz Ltd.,
1328 W. Pender St.,
Vancouver 5, B.C.

Vancal Reproductions Ltd.,
1170 Robson Street,
Vancouver 5, B.C.

ALBERTA

The Alberta Drafting & Blueprint Co. Ltd.,
3250 7th Avenue West,
Halifax, N.S.

Calgary Drafting & Blue Print Co. Ltd.,
615-8th Avenue West,
Calgary, Alberta.

Northern Drafting & Blue Print Co. Ltd.,
10652 - 101 Street,
Edmonton, Alberta.

SASKATCHEWAN

Norcal Reproductions & Engineering Supplies Ltd.,
1832 Lorne Street,
Regina, Sask.

MANITOBA

Fraser Art Supplies Ltd.,
350 Donald Street,
Winnipeg 2, Man.

ONTARIO

Stewart's Stationery Store (Brockville) Ltd.,
198 King St. West,
Brockville, Ontario

Marlin & Lawrie Limited,
22 Gore Street,
Hamilton, Ontario.

Rapid Blue Print Ltd.,
35 King William St.,
Hamilton, Ontario.

Mercury Blueprinting Co. Ltd.,
344 Wellington St.,
London, Ontario.

Penn Stationers,
1942 Main Street,
Niagara Falls, Ont.

Evans & Kert Ltd.,
132 Queen Street,
Ottawa 4, Ontario.

Marlin & Lawrie Ltd.,
393 Cooper St.,
Ottawa, Ontario.

Commercial Photo Copy Ltd.,
74A Geneva St.,
St. Catharines, Ontario.

Manleys Ltd.,
142 Lochiel St.,
Sarnia, Ontario.

H. G. Barter & Son Ltd.,
19 Durham St. North,
Sudbury, Ontario.

Atlas-Helio Co. Ltd.,
124 Merton St.,
Toronto, Ontario.

Curry's Art Store Ltd.,
756 Yonge St.,
Toronto, Ontario.

Metro Blueprint Co.,
97 Eglinton Ave. E.,
Toronto, Ontario.

Copeland's Bookstores Ltd.,
485 Pelissier St.,
Windsor, Ontario.

QUEBEC

Atlas-Helio Eastern Co. Ltd.,
5232 Cote Des Neiges Road,
Montreal, Quebec.

British Blue Print Co.,
1831 St. Catherine St. West,
Montreal, Quebec.

Harrison Co.,
1448 St. Catherine St. West,
Montreal, Quebec.

J. A. Y. Bouchard Inc.,
765 Cote d'Abraham,
Quebec, Que.

NOVA SCOTIA

Mahon's Stationery Ltd.,
88-89 Spring Garden Road,
Halifax, N.S.

ALPHA



HELPS THE HAND THAT SHAPES THE FUTURE . . .



ALPHA

LETTERING EQUIPMENT

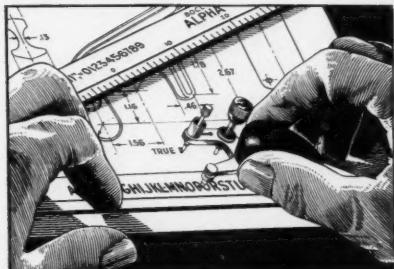
Complete lettering sets with from 3 to 12 templates (caps & lower case). Individual templates available from 60 CL to 500 CL and 60 C to 1000 C. Ask your dealer or write direct for a special brochure.

THE ACU-ARC RULER

The revolutionary new Acu - Arc ruler is designed to provide the draftsman with a straightforward and accurate method of drawing arcs or circles of any radius from 7" to 200" or more. No other single instrument is available to draw arcs or circles of such a large range of radii. Nor is there any other instrument available to draw arcs or large circles quickly, easily and accurately.

Used by designers of Aircraft, Automobiles, Missiles in fact anyone confronted with the problem of drawing large radius curves.

Ask your dealer for a demonstration.



DRAFTING SETS

Giant bow and professional drawing sets, as well as a complete range of single instruments. Excellent style and master craftsmanship give perfection over a lifetime of use.

CASTELL

#9000. The economical wood drawing pencil. Smooth, 100% grit-free, consistently uniform pencil after pencil.

CASTELL LOCKTITE

#9500. Press action drawing pencil with handy pocket clip. Takes full size lead.

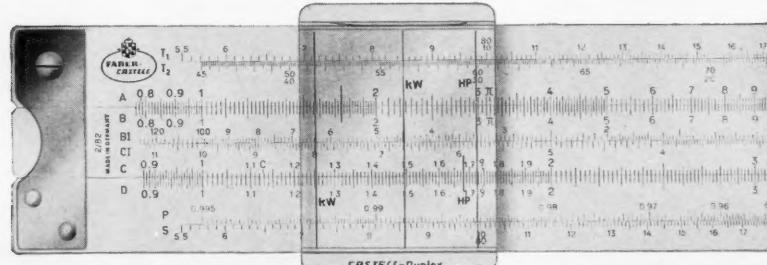
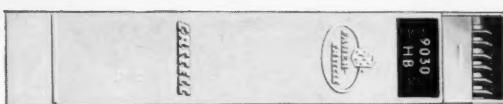
TEKAGRAPH

#9603. The ultimate in precision lead holders. Perfectly balanced to eliminate drafting fatigue.



CASTELL LEADS

#9030. Matching #9000 exactly in quality and grading. Packed 6 to a plastic re-usable container.



CARSEN INSTRUMENTS LIMITED

162 Bentworth Avenue

Toronto 19, Ontario

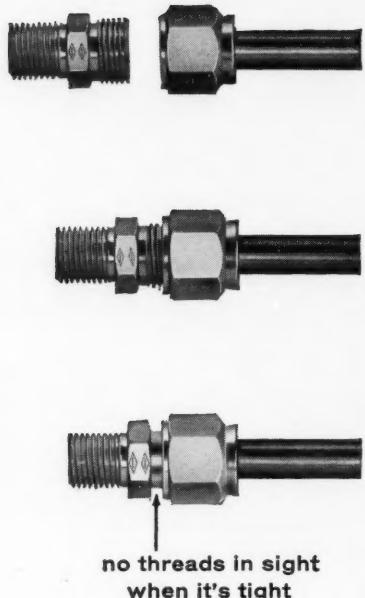
For further information mark No. 113 on Readers' Service Card



you can

see
see
see

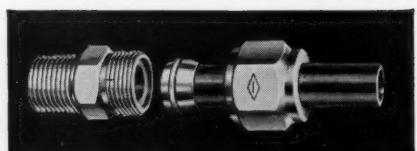
when it's tight



With Hi-Seal you can *see* that hazards are not installed in your tubing system. When the threads no longer show, the connection is pressure-tight. No other fitting offers this advantage.

This means an easy, foolproof assembly that is inspected with just a glance. Anyone who can handle a wrench can make a dependable Hi-Seal joint every time. No need for assembler to count wrench turns. No over- or under-tightening to worry about.

Hi-Seal flareless assemblies are made faster, more economically, more surely. Specify Hi-Seal tube fittings.



BUTT JOINT

HI-SEAL

IMPERIAL  **EASTMAN**
Imperial-Eastman Corporation General Offices: 6300 West Howard Street, Chicago 48, Illinois

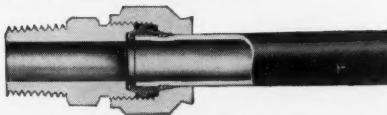
IN CANADA: 18 HOOK AVE., TORONTO, ONT.
For further information mark No. 135 on Readers' Service Card

see

many reasons why

you're ahead with HI-SEAL®

Seeing when they're tight is only one reason for preferring Hi-Seal fittings. Of course, this is a big one for fast, positive inspection and for design engineers who want leakproof, foolproof connections in any system.



Withstand vibration, high pressure — Hi-Seal fittings provide firm tube support for excellent vibration resistance. The fitting is a grip type, rather than a bite type. Three serrations in the sleeve establish the grip without damaging or weakening the tube.

When assembled, Hi-Seal fittings give you a pressure-tight seal compatible with the tubing required. For extreme pressure ranges, Braze-Seal fittings give make and break flexibility.

Make and break 25 times — Simple assembly and re-assembly of Hi-Seal butt-joint fittings mean greater re-use. Hi-Seal's standard is 25 re-uses. The industry standard is 15—or 66 2/3% more for Hi-Seal.

Close bends — Butt-joint H-Seal fittings make close bends possible. Reduce space, material by as much as a half!

One fitting for entire system — Hi-Seal is the most versatile fitting you can use. By standardizing on Hi-Seal, installation and maintenance men can plumb a job fast, yet perfectly, in any pressure range. Available in all styles and combinations, plus a variety of metals—steel, stainless steel, brass, aluminum, titanium, Monel, etc.

Now Imperial-Eastman meets all your fluid piping requirements—tube fittings, valves, couplings, flexible and rigid hydraulic lines, thermoplastic tubing, and tubing tools.

FITTINGS

IMPERIAL - EASTMAN

Technical literature

Control equipment — Catalogue on break-glass switches, control stations, relay panels, etc. Davis Automatic Controls Ltd.

Circle 307 on Reader Service Card

Synchronous motors — Brochure giving technical characteristics, specifications, ratings and outline specifications of various types. American Superior Electric Co. Ltd.

Circle 308 on Reader Service Card

Hydraulic products — 74-page catalogue of a complete line of equipment, including power packages, servo valves and systems, pumps, etc. Vickers-Sperry of Canada Ltd.

Circle 309 on Reader Service Card

Hot dip galvanizers — Directory of Canadian firms engaged in custom and production galvanizing. Consolidated Mining & Smelting Co. of Canada Ltd.

Circle 310 on Reader Service Card

Silicone rubbers — Publication describing product and application data on a complete family of compounds. Canadian General Electric Co. Ltd.

Circle 311 on Reader Service Card

Self-energizing wheel — Bulletin on a special dual-wheeled caster rated at 2,000 pounds, allowing 8,000 pounds to be moved manually on a dolly with four such casters. Roll-Rite Corp.

Circle 312 on Reader Service Card

Gas turbine power — Bulletin discussing the economics of gas turbine power generation, including installation, fuel and operating cost. Clark Bros. Co.

Circle 313 on Reader Service Card

Ultrasonic cleaning — Primer and catalogue on a cleaning operation performed by high-frequency sound waves. National Ultrasonic Corp.

Circle 314 on Reader Service Card

Pressure testing — Brochure on a simple way of recalibrating and testing pressure operated devices, such as switches, recorders and small valves. Brian Engineering Ltd.

Circle 315 on Reader Service Card

Non-resonant choppers — Bulletin describing a complete line of non-resonant switches for chopping electric signals. Bristol Co. of Canada Ltd.

Circle 316 on Reader Service Card

Governors — Bulletin on a governor designed for maximum sensitivity at extremely low pressures and recommended for gas engine installations, pre-mix machines and other gas-air applications

where zero pressure or vacuum opening is required. Canadian Meter Co. Ltd.

Circle 317 on Reader Service Card

Glassteel — 20-page booklet describing a versatile material of construction offering the advantages of glass with all the structural strength of steel. Pfaudler Permutit Inc.

Circle 318 on Reader Service Card

External regeneration — 12-page treatise on the practice of externally regenerating ion-exchange units in condensate scavenging systems, including case histories and comparisons of equipment and costs of in-place vs. external regeneration. Graver Water Conditioning Co.

Circle 319 on Reader Service Card

Molding compounds — Descriptive booklet on the properties, uses and molding requirements of compounds based on Dapon diallyl phthalate resins; intended to provide designers with a handy guide to the capabilities and application techniques of these materials. Food Machinery & Chemical Corp.

Circle 320 on Reader Service Card

Photo-electric control — 8-page bulletin having to do with an infra-red photo-electric control which functions by reflected or interrupted beam over a long range for materials handling, counting, inspection and control installations. Cramer Controls Corp.

Circle 321 on Reader Service Card

Stator encapsulation — Four-page bulletin describing a no-mold method of stator encapsulation to help eliminate motor failure under severe operating conditions. Canadian General Electric Co. Ltd.

Circle 322 on Reader Service Card

Tracing paper — Folder about a tough-as-leather, tissue-thin tracing paper with good pencil and ink acceptance and easy erasure. Keuffel & Esser Co.

Circle 323 on Reader Service Card

Graph sheets — 88-page catalog of papers, cloths and films for sketching, drawing, plotting scientific data, etc. Surveying & Drawing Supply Co.

Circle 324 on Reader Service Card

Drafting pens — Data sheet on an instrument tipped with tungsten carbide, one of the hardest metals obtainable. Keuffel & Esser Co.

Circle 325 on Reader Service Card

Drawing supplies and equipment — Catalogue of instruments, drawing pens, set squares, slide rules, etc. Cansen Instruments Ltd.

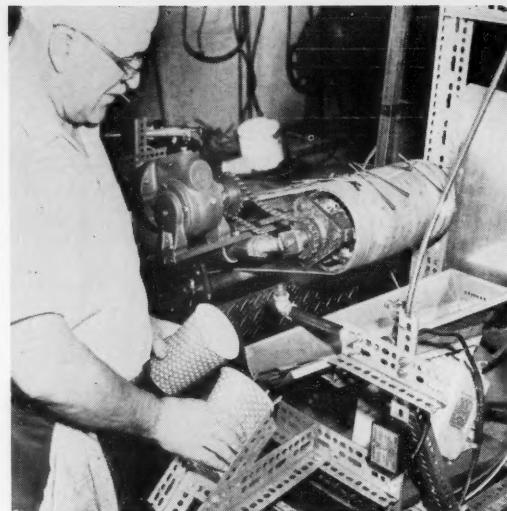
Circle 326 on Reader Service Card

Ideas round-up

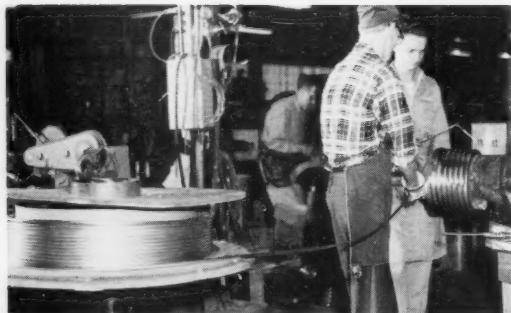
Vibratory feeder solves a problem

A manufacturer of small files had production problems at the delivery end of a belt conveyor handling files from a heat treating furnace and subsequent oil quench operation. The problems were to unscramble the files quickly and without risk to the operator, and to remove the oil still adhering to the files.

Both problems were met by installing a vibratory feeder at the delivery end. The tray of the feeder was positioned under the flow of files and a solvent spray was installed above the tray. The vibratory action of the feeder causes the files to unscramble and move in a straight line up to a 10 deg. incline to the delivery point. The incline causes the degreasing solution to flow to the rear of the tray, where a series of perforations allows it to be picked up for recirculation. Source: Eriez Mfg. Co.



Flat reel, horizontal mounting, make soldering easier



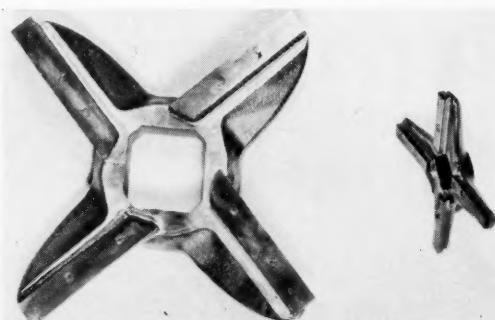
A new soldering technique has speeded the production of cooling coils for office water coolers. Key to the operation is the form in which the tubing comes from the tube manufacturer. Two spirals are used in making the cooler, one carrying the water and the other the refrigerant.

The water tube is supplied in a spiral mounted on a mechanically driven mandrel. The mandrel is turned slowly while the outer, or refrigerant, tubing is soldered on. The refrigerant tubing is supplied on pancake type reels mounted on horizontal rotating tables at waist height. The flatness of the reel ensures that the tubing is wound at a constant angle and height, otherwise soldering would be slow and difficult. Also, horizontal mounting allows smoother manual feed than vertical, since gravity doesn't interfere. Source: Wolverine Tube Division, Calumet & Hecla.

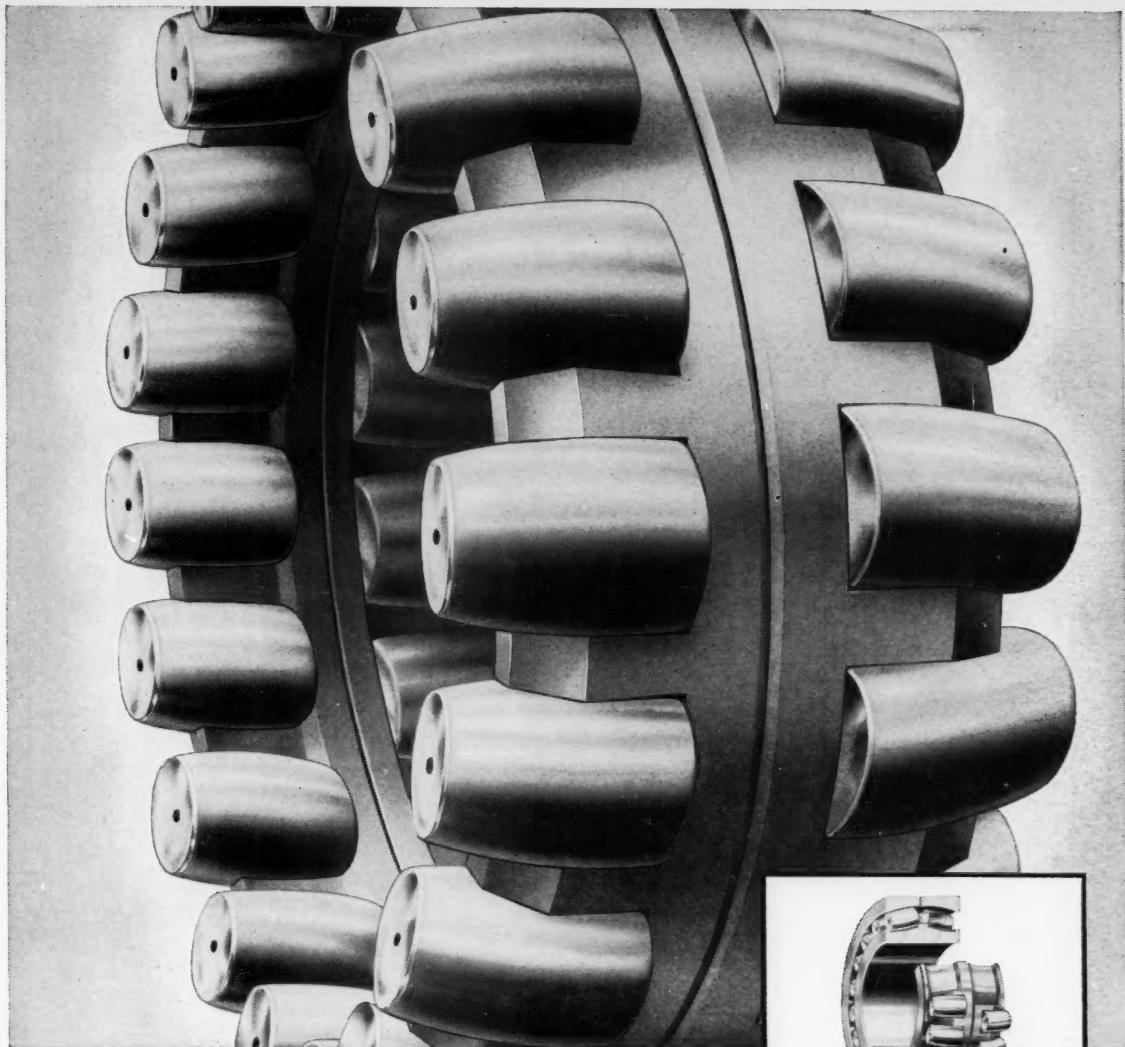
Redesigned blade lasts five times longer

A redesign which effects an interesting compromise in base material selection has cut costs in a commercial meat cutter blade assembly. Originally the assembly was produced as a one-piece iron casting. The strength of the iron casting was workable for this application, but in service the cutting surfaces were frequently exposed to corrosive oils and fats, which contributed to rapid wear and early failure.

The blade assembly was then analyzed for brazing possibilities. The combination of a cast iron spider and stainless steel blades was made possible through redesign for brazing in a pure dry oxygen atmosphere furnace. The redesign not only cuts costs, but also outlasts five cast iron blade assemblies. Also, less finish machining is required. Source: Wall Colmonoy Corp.



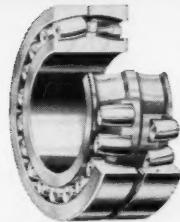
(Continued on page 91)



"Caged" for Longer Life!

The two land-riding cages in Torrington Spherical Roller Bearings assure proper roller spacing and guidance, even under rugged conditions of shock load and sustained high speeds. These fully machined cast bronze cages operate independently. Their design eliminates drag on rollers. These high-strength cages help bearings give longer life by providing low friction, smooth running and cool operation. Highly effective and generous lubrication of all contact surfaces is achieved with the open-end cage design.

The result: Torrington Spherical Roller Bearings are built to give extra years of unmatched service life in heavy-duty applications. Torrington's long experience in design, engineering and manufacture of every basic type of anti-friction bearing provides the finest spherical roller bearings available. You'll find it pays to standardize on Torrington.



Superior design features of **TORRINGTON** **SPHERICAL ROLLER BEARINGS**

- integral guide flange for roller stability
- asymmetrical rollers seek flange for positive guidance
- electronically matched rollers
- size-stabilized races
- fully machined land-riding bronze cages
- controlled internal clearances
- even load distribution
- inherent self-alignment
- long service life

progress through precision

TORRINGTON BEARINGS

THE TORRINGTON COMPANY, LTD. 925 Millwood Road, Toronto 2, Ontario

For further information mark No. 164 on Readers' Service Card



STABILO

3 FIRSTS
IN THE
DRAFTING FIELD

micro



- ✓ Pencils available in degrees 8B - 10H
- ✓ Leads available in degrees 7B-9H

STABILO

MICRO 8000 — MICRO 8125
DRAWING PENCIL DRAWING LEAD

- Guaranteed consistent degrees
- Sharp edges, no powdering, excellent for micro-film work
- Ageproof
- Inklike reproduction



STABILO - MICRO 8-9 CLUTCH PENCIL

- ✓ Triangular, to fit drawing fingers. Drop control-thumb release cap exposes only 1/10" at a time. Lead cannot fall out.
- ✓ Will not roll. Made of unbreakable plastic. Grooves allow firm guidance.

Exclusive Canadian Distributor

HEINZ JORDAN & COMPANY
LIMITED

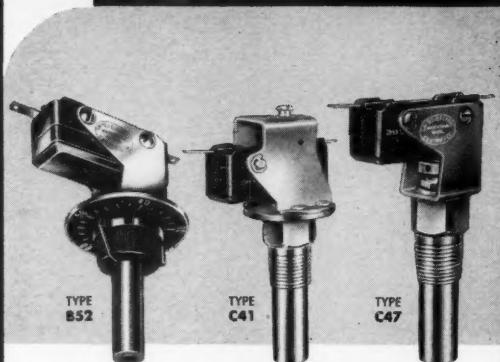
113 Sterling Rd. • Toronto, Ont.

STABILO • Othello • Swano

For further information mark No. 138 on Readers' Service Card

SPACE OR WEIGHT LIMITATIONS?

B52 | C41 | C47



Specify Local Mounted UE SKELETON TYPE TEMPERATURE CONTROLS

UNITED ELECTRIC temperature controls are precision-built, compact and economical. Type B-52 was designed especially for controlling air temperatures . . . Type C41 and C47 for liquid or hot plate temperatures . . . These controls are direct-immersion units designed for easy installation.

Temperature Ranges	Type C41 & C47 100° or 200° between 0° and 425° F limits. Type B52 calibrated 40° F spans between 30° and 120° F.
Thermal Assemblies	various immersion lengths . . . liquid-filled seamless brass bellows operate by hydraulic action
Switch Ratings	15 amps or 20 amps at 115 or 230 volts A.C.; also D.C. switches available upon specification
Switch Actions	N.O., N.C., or Double Throw, no neutral position
Electrical Connection	attached directly to screw or solder terminals on switch
Size & Weight	approx. weight . . . 4 1/2 oz., approx. size . . . 3 7/8" x 2" x 1 1/4"
Variations	design variations available upon specification

UNITED ELECTRIC manufactures a complete line of temperature, pressure and vacuum controls. For applications requiring custom-built units or modified standard units, call upon a UE application engineer for recommendations. Write for complete specification and pricing data on the Type B52, Type C41 or Type C47 local mounted temperature control, and for information regarding other United Electric temperature controls.

UNITED ELECTRIC



CONTROLS (CANADA) LTD.

35 O'Connell Ave.
Dorval, Quebec, Canada

For further information mark No. 166 on Readers' Service Card

Need these books for your files?

The following publications of the Canadian Standards Association are of interest to designers. They are obtainable directly from the CSA, 235 Montreal Road, Ottawa 2, at the prices stated.

Tubular Rivets. This is a new mechanical specification and covers the dimensions and requirements of standard tubular and semi-tubular rivets having oval, truss and flat countersunk heads in a range of sizes from 1/16 to 5/16 in. diameter. Standard materials, finishes, heads, lengths, head forms and other such requirements are given. CSA Standard B71.5-1960, price \$1.50.

Canadian Electrical Code, part I, supplement R-1960. Third edition, superseding the edition published in 1959. Includes all revisions and editorial changes approved to date. Numbering of rules has been correlated to the seventh edition of the code. CSA Standard C22.1-1958, price 75 cents.

Recommendations for Indicating Electrical Measuring Instruments and their Accessories. Second edition replacing one issued as long ago as 1935. This publication of the International Electrotechnical Commission applies to the following types of indicating electrical measuring apparatus for direct and alternating currents: ammeters, voltmeters, single and poly phase wattmeters, varimeters and phasemeters, frequency meters of the pointed and vibrating reed types and ohm-meters. IEC Publication 51, price \$6.00.

Recommendations for Insulating Coordination. Also a publication of the International Electrotechnical Commission. Third edition, contains additions and amendments to the second edition published in 1958. The book states the conditions to be fulfilled by the insulation of the various categories of equipment in the form of general recommendations which should, as far as possible, be common to all of them. IEC Publication 71, price \$3.20.

Recommendations for Ball and Socket Couplings of String Insulator Units. First edition, lays down a series of four standard sizes of ball and socket couplings for use in assembling string insulator units into chains. An appendix gives the dimensions of a series of gages for checking the couplings. IEC Publication 120, price \$8.00.

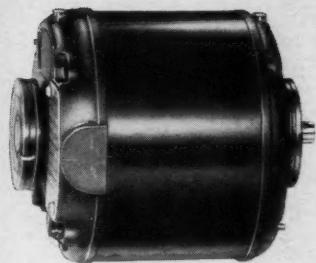
WAGNER CIRCULATOR PUMP MOTORS RUN SMOOTH COOL, AND

* QUIET

The remarkably quiet, smooth operation of Wagner motors is a real advantage in hot water heating system applications. And they're so cool running that they can operate continuously in hot locations without damage.

Made with rugged 48 frame, Wagner motors are exceptionally compact and lighter in weight by 20%. Result: easier installations. Improved *Permawick* lubrication of sleeve bearings reduces maintenance to a new low. Built to C.E.M.A. standards, Wagner Circulator Pump Motors are available in 1/10 H.P. to 3/4 H.P.

Get all these advantages by specifying *Wagner* motors.



WAGNER MOTORS a sound choice for every specific application

Sales Offices:

TORONTO • MONTREAL
WINNIPEG • EDMONTON

Wagner ELECTRIC

Head Office: LEASIDE, ONTARIO

Division of

SANGAMO COMPANY LIMITED
PLANTS: LEASIDE, ONT.; TROIS RIVIERES, P.Q.

For further information mark No. 171 on Readers' Service Card

0128

New products and materials

Copying machine

Half-tones, solid and colored material can be reproduced by a new copying machine, said to be the first compact desk-top copier to use an electrophotographic technique. The machine produces five copies a minute, each an offset master capable of producing up to 200 copies. Apeco of Canada Ltd.

Circle 327 on Reader Service Card

Photocopy dryer

Long runs can be dried as effectively as short runs with a dryer for photocopies and other materials in cut sheet form. Localized cooling is eliminated and the machine uses a 24 in. diameter heavy steel drum with sufficient mass to retain the required amount of heat necessary to do away with local cool spots. Charles Bruning Co. (Canada) Ltd.

Circle 328 on Reader Service Card

Diazo developer

Features of a new continuous action developing machine for Diazo papers are the elimination of ammonia cups and faster print developing production than the conventional stack or tube developers. The developer is charged simply by tipping up a bottle of ammonia. It can be used with any Diazo white-printer and with the larger moist process machines to save time and avoid the nuisance of mixing wet chemicals. Norman Wade Co.

Circle 329 on Reader Service Card

Machine motor



A new series of 26-frame motors for office machines and similar uses is designed with 24 slot stators instead of the conventional 16, thus offering smoother and more constant torque. The stators are machine wound and effective heat

transfer is achieved by a press-fit between the frame and stator. Howard Industries Inc.

Circle 330 on Reader Service Card

New alloy

High temperature strength and oxidation resistance are offered by a new alloy which capitalizes on the best characteristics of nickel, cobalt, chromium, molybdenum and iron. Test data indicate that it has high resistance to oxidation at temperatures up to 1900 F. The alloy is expected to find wide acceptance in areas where the more complex precipitation-hardening steels cause forming and welding difficulties. It is available in sheet, plate, bar, wire and coated welding electrode form. Union Carbide Canada Ltd.

Circle 331 on Reader Service Card

Ball bushing



A ball bushing has been designed specifically for use on die sets. Interchangeable with standard plain bronze or steel bushings, it is provided with a pilot dimensioned to fit the mounting hole in standard punch holders and is so constructed as to eliminate seizure smash-ups. Thomson Industries Inc.

Circle 332 on Reader Service Card

Multi-point controller

A new electronic multi-point temperature controller developed in Canada provides accurate two-position control for up to 10 processes. The instrument can also be used as a single point controller, a five-point three-position controller and a manual-balance indicator. Controls and switches are located at the front, with ten white lights showing scanning position, ten red ones to show process condition and ten knobs for setting control points. Thermo Electric (Canada) Ltd.

Circle 333 on Reader Service Card

TRY ONE
AT OUR EXPENSE

MARS
LUMOGRAPH
SPECIAL DRAWING PENCILS



Men who use them once use them again and again. Excellent for photoprint work since the opaque lines compare favourably with India ink drawings. Your choice of 19 degrees (ExEXB, ExB, 6B-B, HB, F, H-9H), Mars Lumochrom coloured pencils — no smudge, waterproof, hard leads — available in 24 colors. All colors reproduce.

Send coupon for sample, indicating which you would like. Sold by leading engineering and drafting material suppliers. J. S. STAEDTLER CANADA LTD., TORONTO.

J. S. STAEDTLER CANADA LTD.
1162 Caledonia Rd., Toronto 19

Please send me () Mars Lumograph Pencil
() Sample of Mars Lumograph Leads.

NAME TITLE

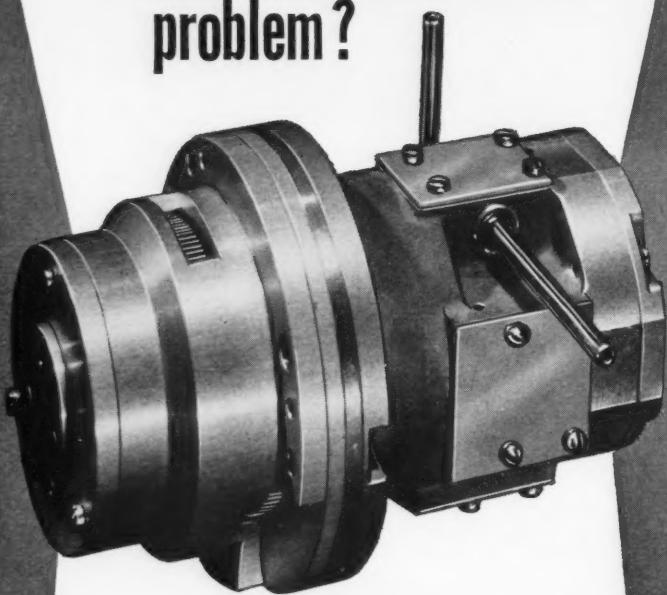
FIRM

STREET

CITY PROV

For further information mark No. 156

is this the missing component in your instrumentation problem?



AVIATION ELECTRIC'S NEW BALL RESOLVER

A new miniature calculator that has many applications in the general field of engineering design is currently being manufactured by Aviation Electric Limited of Montreal. The unit illustrated is being used with great success in Canada for the automatic calculation of sine, cosine and tangents in advanced navigational systems. Compact and light in weight, this resolver offers great accuracy of performance under the most rigorous conditions.

Based on a 19th century invention, the principle behind the new resolver is remarkable in its simplicity. Aviation Electric engineers, however, had to overcome many difficulties of design to develop a miniaturized instrument capable of instantaneous and continuous calculations to an accuracy greater than 0.3%, under conditions of great stress, with a temperature variation from +160°F. to -65°F.

Miniature resolvers are destined to play an important part in guided missile control and future technological advances of many kinds. Aviation Electric will be glad to discuss the application of this new ball resolver to your instrumentation problems and, if necessary, to design an entirely new unit for your purposes.

For further details and illustrated literature write to:

AVIATION ELECTRIC
LIMITED

200 Laurentien Blvd., Montreal, P.Q.

Branch Plant:

Aviation Electric Pacific Limited, Vancouver Airport, Vancouver, B.C.

For further information mark No. 105 on Readers' Service Card

New products

(Continued)

Epoxy adhesive

An epoxy adhesive has been developed to provide high peel strength of 63 in.-lbs on aluminum to aluminum. It is recommended for bonding aluminum honeycomb panels, ferrous metals, ceramics and glass. The tensile shear strength is 3,300 psi, the pot life three days and the elongation 45%. Hysol (Canada) Ltd.

Circle 338 on Reader Service Card

Solenoid valve

Though primarily designed to handle gas to industrial and commercial boilers and furnaces, a new compact solenoid valve can also be used in any low pressure control system, for instance as an electrical checking device for vacuum pumps and systems. It has $\frac{3}{4}$ in. pipe connections, forged brass body and bonnet, and a soft composition disc. Davis Automatic Controls Ltd.

Circle 339 on Reader Service Card

Ionization chamber

A new high-temperature ionization chamber is available for detection of thermal neutrons in the range 2.5×10^4 to 2.5×10^{10} neutrons per square centimeter per second. The tube can operate continuously at temperatures up to 500°F. It employs guard ring construction to minimize signal leakage through insulators and is equipped with type HN connectors. Canadian Westinghouse Co. Ltd.

Circle 340 on Reader Service Card

Folding magnifier

A powerful magnifier with built-in divider folds into a neat rectangle measuring about 2 by $1\frac{1}{2}$ in. It has been designed mainly to fill the gap between rough estimation and precise measurements with expensive instruments. Grati-cules Ltd.

Circle 341 on Reader Service Card



"I guess we should have made the drawings before we produced it!"

New products

(Continued)

Magnifying viewer

A new illuminated magnifying viewer for work benches provides full three-dimensional perception plus independent adjustment of lens and light. It is ideal for the assembly of small parts and eliminates eyestrain and posture fatigue sometimes caused by smaller lenses. A 4½ in. universal mounting base allows easy attachment to any surface. Fostoria Corp.

Circle 342 on Reader Service Card

Diazo film

Say you want to make revisions of an original drawing without marring it. For this situation a new polyester base diazo film has been developed. The original is printed in reverse on the sensitized diazo coating, then erasures are made with a chemical eradicator or minor deletions with a rubber eraser. After that the drawing is turned over. Keuffel & Esser Co.

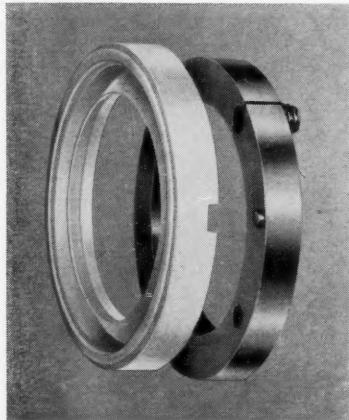
Circle 343 on Reader Service Card

Directional valve

A new four-way solenoid controlled, pilot-operated directional valve offers the twin advantages of 50% greater capacity and considerable reduction in valve centring time. Another feature is exceptionally quiet and cool operation. Vickers-Sperry of Canada Ltd.

Circle 344 on Reader Service Card

Lip seal

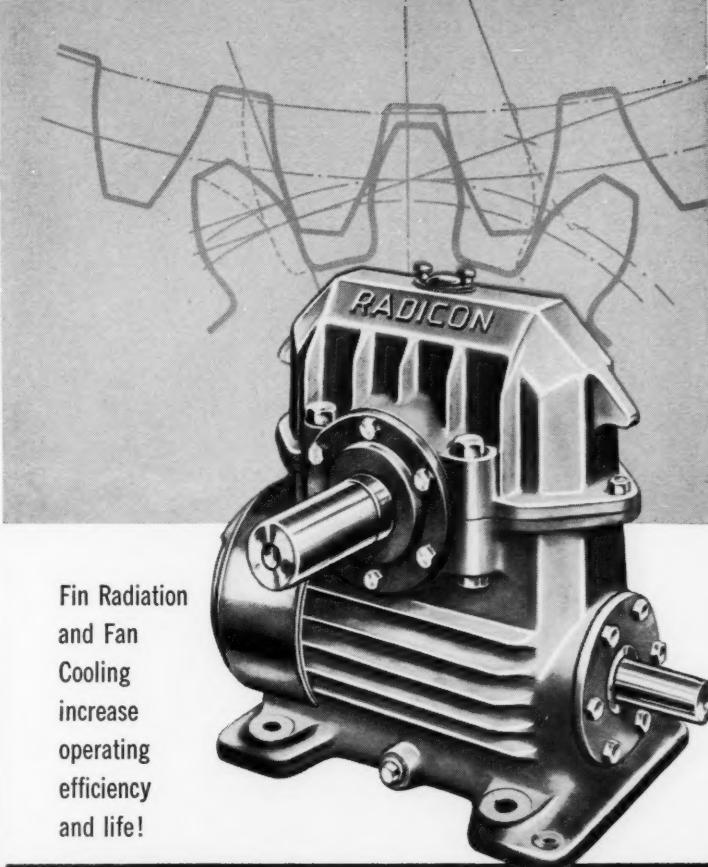


A new lip seal controls the amount of liquid injected into the stuffing box and prevents abrasion in process fluids from reaching the mechanical seal. The lip seal is composed of two parts, a split expansion collar and a floating Teflon lip sealing ring. Purpose of the collar is to lock the lip seal into operating position. Durametallic Corp.

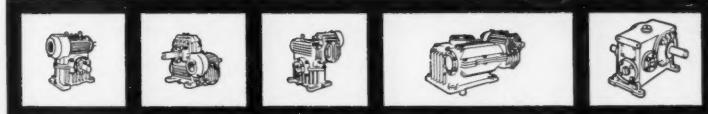
Circle 345 on Reader Service Card

(Continued on page 80)

Specialists in Power Transmission **100 years** of service to industry



Fin Radiation
and Fan
Cooling
increase
operating
efficiency
and life!



Radicon Speed Reducers

Greater power transmission ability per dollar invested in the reducer! — this is the big advantage offered by self-cooling Radicon.

The unique Radicon design in both single and double reductions enables these units to handle a wide range of output speeds.

For transmitting $\frac{1}{2}$ to 4 H.P. specify "Little Radicon". These sturdy compact units are available in a variety of sizes — can be mounted in 24 different positions — in many cases can save you the cost of a "special".

Investigate the economy of Radicon before you order your next speed reducer. Write today for our latest catalogue.



**DAVID BROWN
FOOTE GEARS**

26 Howden Road, Scarborough, Ont. Phone PL 5-5271

For further information mark No. 109 on Readers' Service Card

60-4

79

New products and materials *continued*

Squeeze valve

A new valve has a unique squeeze action which automatically controls the flow of air, oil, chemicals and even grinding slurries, without the use of poppets or spools. There are no metal-to-metal contacts and no metal-to-rubber seals. This maintenance-free construction makes the valve particularly suitable for the petroleum, chemical and nuclear industries where contaminated

fluids and gases present a problem. Airmatic Valve Inc.

Circle 346 on Reader Service Card

Air filter

A compressed air filter removes moisture and oil vapor without swelling or increasing in particle size, thus leaving the free flow of air or gas unimpeded. It will absorb both moisture and oil vapor, divesting itself of moisture not

oil. By giving positive protection against oil getting into the equipment, it eliminates all chances of oil vapor damage in chemical processing, air tools, etc. Beach Sta-Dri Filters Canada Ltd.

Circle 347 on Reader Service Card

Positioner

A new electrical-mechanical servo device automatically positions machine tools, valves, float levels, doors, hopper gates and so on at any of the several predetermined positions, corresponding to a control selector switch signal. The positioner is used in conjunction with various types of power mechanisms such as an air or hydraulic cylinder. Williams & Wilson Ltd.

Circle 348 on Reader Service Card

Rod ends

Rod ends, either male or female threaded, can now be obtained with a lining of Du Pont "Teflon" woven fabric. They provide all the advantages of high load rating inherent in this type of single-ball bearings plus the long wearing, low friction, self lubricating, high impact properties of the fluoro-carbon fiber. Bonding the fabric to the substrate ensures no float or break-away. R. & M. Bearings Canada Ltd.

Circle 349 on Reader Service Card

Latching relay

Closer stacking of circuit boards is possible with a latching relay having its smallest dimension perpendicular to the plane of its mounting surface. The relay is usually used without brackets or studs, thus simplifying installation. It can remain firmly latched in armature position without applied coil power and is designed to operate in severe environments. Potter & Brumfield Canada Ltd.

Circle 350 on Reader Service Card



RP-SCOPE

**21 ways reinforced plastics improve existing products...
...make new products possible**

1. Highest strength/weight ratio
2. High Modulus of Elasticity
3. High dielectric factor
4. Lighter than aluminum
5. Only slightly heavier than hardwood
6. Fire retardant—some grades fireproof
7. Waterproof and rot-proof
8. Rodent-proof and termite-proof
9. Corrosion-proof—resists 90% of the 34 most corrosive substances
10. High and low temperature stability
11. Low cost—about one dollar per-pound-manufactured
12. Versatile—molded or fabricated into products from 1 oz. up to 100 ft. high
13. Permanent—does not weaken, craze, or discolor with age
14. Colorful—any colors or shades can be processed right into the material
15. Excellent electronic properties
16. Excellent non-magnetic properties
17. Excellent acoustic properties
18. Up to 70% less tooling cost for moldings—50% less tooling time
19. Runs as low as 500 moldings practicable
20. Easily machinable with correct tools
21. Easily repairable if damaged

PLUS many hundreds of special advantages in specific applications. Protectolite Reinforced Plastics, molded or fabricated to your designs, have the greatest scope of all industrial materials. RP-SCOPE is only limited by your own imagination.

ASK FOR RP-SCOPE DATA SHEETS



Molded and fabricated to your design by
PROTECTIVE PLASTICS LTD.
UPTON ROAD, SCARBOROUGH, ONT. PL. 5-0781

For further information mark No. 149 on Readers' Service Card



"The craftsmanship is superb, Charlton, but perhaps you should select a more practical scale for working drawings."

Briefs

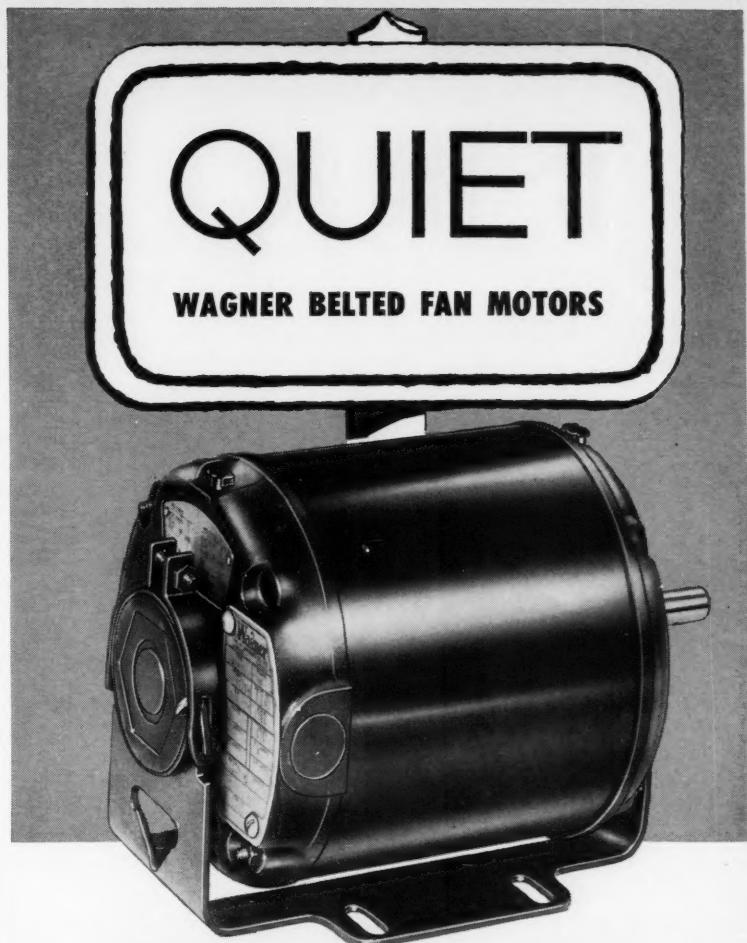
The designer's dream of international fame came true for four creative engineers at Canadair who developed a new obstetrical aid designed to speed up and ease childbirth. The news won headlines at home and abroad. The device is a thermoplastic dome which fits over the mother's abdomen to reduce atmospheric pressure on the abdominal walls, and so assists the muscles to distend and relax alternatively during the early stages of labor.

We had some idle thoughts about the Canadair project, for example: How many of the engineers are married men with families? Are there any bachelors in the team? Are any of the married men expectant fathers? Were any pregnant wives consulted during the research stage? and so on. We took these questions to Canadair's PR department, but they ignored us, probably feeling that the questions were too facetious for such a serious subject. So we don't know anything about the marital and expectant status of the four engineers concerned, but at least let us place their names on record: R. J. Higman, director of missiles and systems division, Ian Gray, chief test engineer, Gordon Lloyd, leader of the laboratory services group, and Kenneth Cole, group leader in mechanical design.

Miscellany: Two unusual engineering groups we recently heard from for the first time are the Society of Vacuum Coaters and the Flexible Unicellular Insulation Manufacturers Task Force . . . Students entering Cornell University College of Engineering this fall will be enrolled in a new Division of Basic Studies that will provide freshmen and sophomores with a program common to all engineering fields . . . **Montreal inventor** has come up with a remote control device which starts the engine of his car while he's still in his house or office . . . **the world's first** high-speed, mass transit monorail will be built in Seattle, Wash., where it will carry 8,000 passengers per hour from downtown to the Century 21 Exposition next year at a speed of 75 mph . . . longest safety record of any Ontario company is 5,848,140 man-hours free of accidents, chalked up by **International Business Machines** of Don Mills . . .

Here's an item about a large Dayton, Ohio, bakery firm which has installed a vibratory feeder to spread measured quantities of chocolate decorlettes, butterscotch bits or shredded coconut on pie tops. Why do we pass on such news? Because it's an excellent example of

(Continued on page 82)



Specifically designed for silent heating and air-conditioning!

Resilient mounted sleeve bearing Wagner motors absorb vibrations to eliminate sound that can travel through heating and air conditioning systems. They're *whisper-quiet* . . . ideal for hospitals, theatres, churches, executive offices and finer homes. *More compact* too, with new smaller 48 frame—yet extremely rugged.

Wagner motors have improved lubrication of sleeve bearings with the *Permawick* system that requires an absolute minimum of servicing. Built to C.E.M.A. standard mounting dimensions. Available in 1/6 H.P. to 1/3 H.P. split phase. For quietness and dependability, specify Wagner.



RBR-2 (large illustration) split phase 1/6 to 1/3 H.P. 48 frame.
RKR-2 (small illustration) Capacitor start 1/2 and 1/4 H.P. 56 frame.
Both motors standard protected, sleeve bearing—resilient mounting. 115, 115/230 V. 1800 p.p.m.

WAGNER MOTORS

a sound choice for every application

Wagner ELECTRIC

Sales Offices:
TORONTO • MONTREAL
WINNIPEG • EDMONTON

Head Office: LEASIDE, ONTARIO

Division of
SANGAMO COMPANY LIMITED
PLANTS: LEASIDE, ONT.; TROIS RIVIERES, P.Q.

For further information mark No. 170 on Readers' Service Card

Briefs — *continued*

a manufacturer finding new markets. Eriez Manufacturing Co., of Erie, Pa., sold the bakery two such feeders, one for coating pies and the other for experimental operations. One of the most promising new applications to date is handling flour to "lubricate" rollers and prevent dough sticking.

Canadian Westinghouse PR man sends us a note, "I thought you might be interested in the manner in which the Japanese government reacts quickly to

foreign competition." Attached is an extract from "Japanese Business News" reporting that the Finance Ministry's tariff council (an advisory body) has recommended that the government should establish an emergency tariff system. "This," says the magazine, "could counter any sudden influx of foreign goods which would hurt the Japanese industries turning out the same kind of commodities . . ."

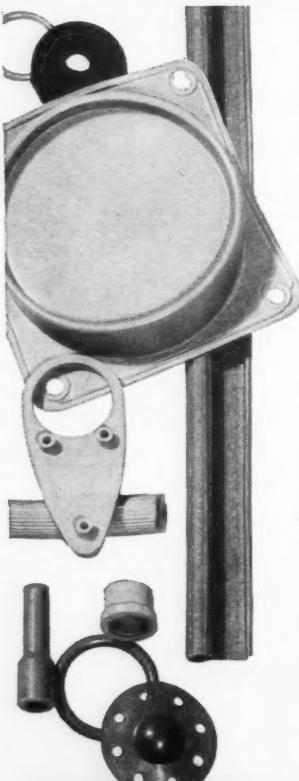
Notes on new processes, techniques and developments: **General Electric** scientists have achieved breakthroughs in microwave tube technology which make possible new superpower radio-

frequency sources capable of producing many times more power than conventional types . . . **U.S. firm** which developed "close cluster" stamping technique for producing precise preforms of precious metals for the semiconductor industry is now using the same technique to produce silver brazing preforms . . . **Research by Cornell University** has shown that machining metals in the 73 to 1,200 F. range increases the efficiency of metal removing by cutting tools . . . **New titanium** coloring process coats the metal in brilliant colors without harmful dies or paints . . . **Electronic testing** device has been developed which materially reduces the time spent in checking wiring of complex electronic equipment . . .

This and that: **Honeywell Controls** Ltd.'s parent firm developed a space cabin in which two U.S. Air Force astronauts spent 30 days in isolation resembling space travel; the 8x12 ft. cabin includes devices that enable the volunteers to drink and re-drink the same water and re-breathe the same air . . . **English draftsman** is conducting a one-man war against bareheaded bus conductors; if they don't wear hats he won't pay his fare — a protest against Manchester Council's refusal to hire Sikhs (whose religion requires them to wear turbans) . . . **United Steel Corp.** transmission units are now equipped with a device to eliminate the entry of grit or dirt through the grease fitting . . . **U.S. Post Office** machine that reads addresses on letters has been improved to handle mail printed entirely in capital letters and postal zone numbers; previously it ignored zone numbers and could only manage upper and lower case type . . . **Department of Trade and Commerce**, planning the biggest trade fair program in Canada's history, has issued a booklet pointing out that one of the best ways a Canadian business can expand its export sales or break into a new market is by exhibiting its products and services at trade fairs in the target area . . . **New service** organization formed in the U.S. under the name Theoretics Conception Creation offers "continuous representation at government levels in all categories," has offices in Washington and other cities where there are large military procurement offices; what does the company sell? freelance lobby service . . .

Where ordinary rubber fails

Armet Silicone RUBBER



- EXTRUSIONS
- MOULDINGS OR FABRICATIONS

MAY SOLVE YOUR PROBLEMS

Where you have a problem involving heat, cold, compression set, weathering, ozone, oils, fuels, chemicals, moisture or steam, it will pay you to investigate how Armet Silicone Rubber can improve your product.

Armet also extrudes, moulds or fabricates Viton, Hypalon, Neoprene and Buna N.

For information contact:

ARMET INDUSTRIES LIMITED
Rubber and Plastics Division
GUELPH, ONTARIO

SALES OFFICE: 18 Coldwater Rd., Don Mills, Ont.

For further information mark No. 101 on Readers' Service Card

Talepiece: A New York newspaper has this to say in an article on the 1961 cars: "The steering wheels of the 1961 models are smaller than their predecessors, except where they are no longer round, in which case the rectangular wheels are wider than they are high." So now we know, even though we don't understand

TEST

the unique properties
of this sample



BOILING: Boil this sample in water indefinitely. Notice that there is no change in appearance, elasticity, colour or strength. This ability of Silastic to withstand moist heat and low pressure steam makes it an ideal gasketing material for steam irons, washing machines and dish washers.

FREEZING: Now freeze it in the ice cube tray of your refrigerator, take out the cube and break out the sample. Even after weeks of freezing it is just as rubbery and resilient as ever. Silastic at low temperatures remains pliable and elastic and is an ideal rubber material for aircraft seals, and innumerable extruded and moulded parts destined for cold exposed areas.

BAKING: For a really tough test leave the sample in a 500°F oven for hours. Again the Silastic is unaffected. This characteristic makes it an ideal material for oven door gaskets, hot air ducts, belt coverings and electric frying pan gaskets. You may have a Silastic gasket on your oven.

HEAT CONDUCTING: Place the sample on a burning light bulb and hold it with the end of your finger. In a short time you will feel the heat through the Silastic. This demonstrates its excellent thermal conductivity. This ability of Silastic to conduct heat quickly is very useful in motor insulation, wire coverings and all types of electrical equipment.

Good thermal conductivity means cooler equipment, smaller equipment and more efficient equipment. It is also important in totally encapsulated parts where the Silastic protection does not mean a hotter operating part.

PARTING: Try to stick a piece of pressure-sensitive tape to this sample. Nothing sticks to Silastic (except of course Silastic adhesives). This characteristic is most important wherever there are release problems. Silastic is used for roll coverings and belts handling sticky materials. Silastic gaskets or seals are easily removed.

BURNING: If you hold a match to this sample IT WILL BURN. The interesting thing is the ash — it is silica. When Silastic burns, it does not carbonize, but remains an excellent insulator. This is very important in all electrical applications. Even when the insulation burns the ash continues to insulate. Silastic will never char and conduct.

SILASTIC

Silastic is the Registered Trade Mark of Dow Corning Silicones Ltd.

from one extreme to the other
is the story of Silastic Silicone Rubber
HERE ARE SOME

applications

There are many other tests that Silastic passes easily but the nature of these tests is such that we could not ask you to try them. One example is solvent resistance. There are Silastic stocks with excellent resistance to gasoline and aromatic solvents that are used in the chemical, petroleum and automotive industries. Another is resistance to ozone and corona, most important in the electrical industry. Another is resistance to weathering: there are innumerable outdoor applications for seals, gaskets, extrusions and wire coverings where only Silastic will last indefinitely. Another is toxicity. Silastic is non-toxic — so non-toxic that artificial heart valves that have to last a lifetime are made from it. There are many other medical, pharmaceutical, and food applications. Silastic is of course unaffected by moisture. Open-frame Silastic insulated motors are regularly cleaned with a hose — while running. Silastic is also resistant to: abrasion, corrosive atmospheres, chemicals and radiation. Take our word for it — there are Silastic stocks that are unaffected by most or all of these tests. Silastic may be moulded, dispersion coated, extruded, coated on wire or calendered. It can be fabricated as readily as organic rubber and can of course be pigmented to almost any desired colour.

Possibly the greatest challenge to industry are the Dow Corning Silastic RTV's. These are liquid rubbers that vulcanize at room temperature—and the vulcanizing time can be as brief as 2 minutes or as long as 24 hours. When it sets up, Silastic RTV has the same basic characteristics as the stocks discussed above. Delicate electronic components can be dipped in it. It can be used to pot whole assemblies. It is the most durable caulking material we have ever seen. You can use it to make your own gaskets. You can also use it

to make moulds or copies of intricate shapes. It will reproduce detail as fine as fingerprints. A new use for Silastic RTV is the encapsulation of random-wound motor coils to provide protection from moisture, water, dirt, vibration, abrasives, chemicals and thermal and mechanical shock. Should a Silastic-protected part or component ever need service the rubber can be cut, the repair made and the Silastic RTV resealed with more self-curing Silastic RTV.

Silastic costs more pound for pound than many other materials. However, the cost of any material is not always what it seems. To find the real price of any item, you have to relate its cost to how well it does the job. In other words you just can't equate price-per-pound to performance. So you're better off to design 'through a problem' with Silastic, than around it with other materials.

You might well say "O.K., Silastic is fine for special purpose applications where premium materials are needed and premium prices can be afforded, but where are the across-the-board applications in ordinary products?" Daily, Silastic in its many forms is moving out of its specialized areas of application to find growing acceptance in industry. Its characteristics mean reliability of a new order, thus long-term economy through reduced or eliminated maintenance and repair of industrial and consumer products.

If you are interested in Silastic silicone rubber we will gladly supply you with complete technical data and samples. Dow Corning does not manufacture parts of Silastic or Silastic coated wire, but we can give you the names of Silastic fabricators or wire manufacturers in your area. We do stock and supply, direct to you, all types of Silastic RTV silicone rubber. For information contact any of our branch offices.



Dow Corning Silicones LIMITED

VANCOUVER TORONTO MONTREAL

Motions from the floor should not be binding unless letter ballot taken

Dear Sir:

I was most interested in the January Opinion Poll, "Should P.Eng. Associations allow time at annual meetings for motions from the floor?" I was also interested in your editorial comment on the difficulty you had in obtaining answers to your question. I agree with you that probably the real reason for this difficulty was that those questioned did not attend the annual meetings of the Association and did not know, therefore, whether their own Associations permitted discussions and motions on the floor.

It is a fact that in this Association, at least, and I suspect the same applies in other Associations, only about 10% of the membership attend the annual meeting. For many of those, of course, outside the Vancouver and Lower Mainland area, it is not easy to attend. Strangely enough, however, we have a better percentage of attendance when our annual meetings are held in Victoria, where a much smaller percentage of our membership resides, than in Vancouver.

No Autocracy

I agree with the principle that there should be ample opportunity at the annual meeting of an Association for the membership to discuss the affairs of the Association and to submit motions concerning them. I do not feel, however, that the Council of the Association can be bound by such a motion, unless it has been submitted to the full membership by letter ballot; otherwise a motion passed by a minority of the membership, which was not considered by Council to be in the best interests of the profession, could be made binding.

Frequently motions are submitted from the floor of such a meeting on the spur of the moment and passed without too much thought to all the implications and the effects of such action.

The Engineering Profession Act under which this Association operates does provide, and I presume Acts in other provinces have the same provision, that letter ballots must be taken by the Council at the written request of 25 members of the Association. This, then, provides the members with the opportunity to ensure that Council does not act in an autocratic manner. The members also, of course, have the

opportunity of electing the Council so that if they do not approve of actions of Council in one year, they may, as in any democratic procedure, turn them out the following year.

I would not like to close, incidentally, without expressing my apprecia-

tion to you and your magazine for giving attention to matters such as this.

J. Marchant, P.Eng.
Registrar,
APE of B. C.

Vancouver



Pelikan

Chin-Chin

WATERPROOF DRAWING INKS

REGULAR DRAWING INKS:

Do not run and stand erasing well. Supplied in black and 22 brilliant shades guaranteed against sediment (except white).

NON-ETCHING DRAWING INKS:

T
TN
C

Adhere to Mylar base material, waterproof tracing linen, Acetate, Astrafoil, Vinylite, Ethulon, etc. "T"-ink, black and 22 shades. "TN" and "C"-ink black only.

ETCHING TYPE DRAWING INKS:

S
K

Made for Astralon and other thermoplastic materials not less than .005" in thickness. Black and 5 shades. Matted surfaces to be cleaned with "FKS".

FKS — cleaning fluid

VKS — thinner

LKS — solvent for cleaning instruments



IF IN DOUBT:

let us have your special type of drawing material. Send fair size sheet marked with the name of the material so that the Pelikan laboratories can make their tests to assure the proper special drawing ink to be used.

WRITE FOR FREE CHIN-CHIN INK SELECTOR CHART

Exclusive Canadian Distributor

HEINZ JORDAN & CO. LTD.

113-125 STERLING RD.

TORONTO 3, ONTARIO

For further information mark No. 139 on Readers' Service Card

People and events

CGE gets U. S. contract

Canadian General Electric Co. Ltd. is manufacturing electronic equipment to the value of one million dollars as part of a larger contract awarded to its parent company. The contract is for long-range search radar equipment.

Under the sub-contract, C.G.E. will produce a number of oscillator-drive radar units by April 1961. Parts of the order are being sub-let to component manufacturers in Canada.

The search radar equipment incorporates many of the most advanced

signal processing circuits and techniques and is designed to detect strategic, supersonic aircraft at longer ranges and higher altitudes than present-day operational air defense search radars.

The antenna system for the new radars is one of the world's largest rotating radar structures. Comprised of a reflector, pedestal and feedhorn erected on a 50 ft boom, the system measures 120 x 50 ft and weighs more than 135 tons.

INCO promotes stainless

For the third year in succession, the International Nickel Co. of Canada Ltd. has initiated a sales and market program for stainless steel. Among those participating are Atlas Steels Ltd., Canada's largest manufacturer of stainless, major manufacturers of stainless products and Eaton's of Canada coast to coast.

The promotion, known as "The Gleam of Stainless Steel," is being backed by Inco advertisements in 52 daily newspapers, consumer and financial magazines, together with commercials on 27 radio stations. Eatons will support the campaign with window and interior displays of stainless steel products and with local advertising.

A similar Inco promotion is being launched in the United States, also for the third year in succession. There the promotion will involve 61 major department stores representing 141 branches.

K. H. J. Clarke, manager of Inco's Canadian sales and market development, told a recent press conference in Toronto that Canada's interest in stainless steel was growing considerably, but could be increased by encouraging new fabrication in stainless steel consumer products and by influencing designers in its potential applications.

"Its practical beauty is constantly winning new friends among Canadian housewives," said Mr. Clarke, stressing that the key to its increasing popularity is durability, ease of cleaning and the bright "quality" appearance.

Making potentiometers

Bourns Inc., of Riverside, Calif., have formed a Canadian subsidiary to supply potentiometers to this market, including the Department of Defense. Bourns (Canada) Ltd. have leased a 7,000 sq. ft. plant at 36 Cranfield Rd., East York, Ont., where the units will be manufactured to rigid specifications.

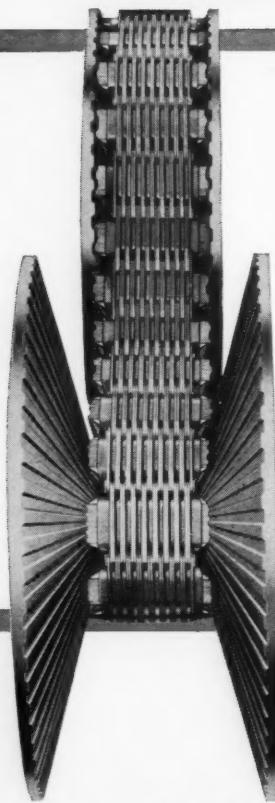
An agreement between the U. S. company and their Canadian licensees, Douglas Randall Ltd., was terminated by mutual agreement. Under the agreement Bourns acquired equipment, tooling and personnel related to the manufacture of Trimpot potentiometers.

(Continued on page 88)

UNIQUE IN ITS FIELD

THE P.I.V. GEAR

POSITIVE INFINITELY VARIABLE



For a variable speed gear which is *positive* there is no alternative to the P.I.V. It is absolutely positive as the patent chain and wheel faces ensure "No Slip". An infinite variation of speeds up to a range of 6 to 1 can be obtained. The speed can be adjusted under load and will remain constant.

The high efficiency is maintained as the correct engagement of the chain with the discs is independent of stretch and other related factors. The gear has a very long life as no part is subject to wear except the chain; the life of which depends on the load, but can be reckoned in years.

FOR DETAILED INFORMATION WRITE FOR ILLUSTRATED CATALOGUE.



CANADIAN REPRESENTATIVES

STONE FRANKLIN OF CANADA LIMITED

MONTRAL: 7035 Grand Ave., Cr. 1-2397

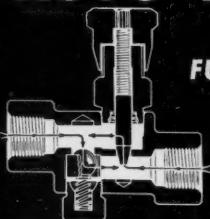
TORONTO: 603 Royal Bank Bldg., Em. 3-9033

For further information mark No. 162 on Readers' Service Card

AUTO-ONENT[®]

HYDRAULIC

FULL FLOW VALVES



Flow Control, Needle, Check, for HYDRAULIC Power

Model KF Flow Control Valve with Dial and Knob adjustment for direct reading and duplicating reference. Now available in Aluminum for 3000 psi.

Pat. #2,841,174

A complete line: 1/8", 1/4", 3/8", 1/2", and 3/4" female Dryseal Pipe Sizes in all models and types. Equivalent Aeronautical Tube Sizes on special order.

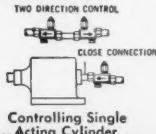
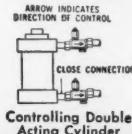
MINIMUM PRESSURE DROP AND POWER LOSS . . . Oversize ports and passages give maximum flow at minimum pressure drop, insure greater accuracy and response in hydraulic or large volume air cylinder control.

EASY FLOW ADJUSTMENTS under full pressure. Seal located at port to eliminate air or dirt traps. Gland structure equally effective on pressure or vacuum.

SENSITIVE, CHATTERLESS BALL CHECK . . . Patented design insures rapid ball movement to open or close at low differentials.

FORGED BODIES permit higher pressures with wide safety margins. Aluminum—3000 psi; Steel and Stainless Steel—5,000 psi. Pressure ratings based on better than 5 to 1 safety factor. All internal parts are Stainless. Write for illustrated catalog.

TYPICAL APPLICATIONS

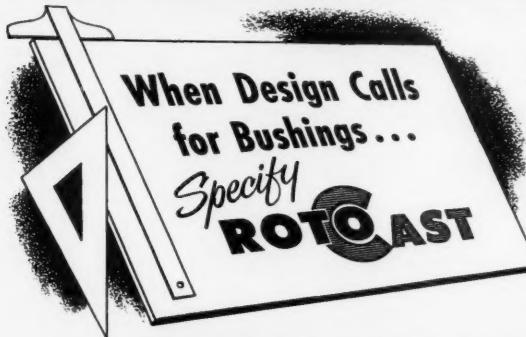


Controlling Double Acting Cylinder

Controlling Single Acting Cylinder



For further information mark No. 102 on Readers' Service Card



CENTRIFUGAL BRONZE BARS or Precision Finished Bronze Bushings



■ ROTO-CAST assures you of bearings that are free from porosity, microshrink and blow holes. Our precision machining gives you bushings that are of close tolerance, concentricity and fine finish. ROTO-CAST is a high quality bar — the most economical for maintenance or production. Write for our technical literature.

THE CANADA METAL COMPANY LIMITED

721 EASTERN AVE., TORONTO 8 HO. 5-4684

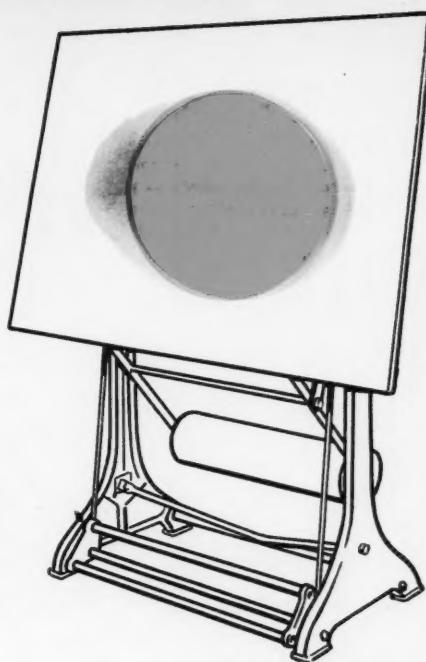
Contact our nearest Branch

MONTRÉAL SCARBOROUGH WINNIPEG CALGARY VANCOUVER

For further information mark No. 111 on Readers' Service Card

DESIGN ENGINEERING FEBRUARY 1961

Touch it!



This is KSL drafting board cover which is resilient and durable. It can be washed off with soap and water. KSL drafting board cover is available in all shapes and sizes. You may glue it onto your board or staple it on the top only. Prices are low. Make sure to buy KSL drafting board cover or write for prices and information.

Pleasure and satisfaction are yours when you work with

Kuhlmann

drafting tables and precision drafting machines

Kuhlmann equipment is well built, precise, available from stock close to wherever you are, serviced from coast to coast, and backed up by the world's most experienced team of drafting machine specialists.

It costs no more to buy Kuhlmann. Write for catalog and prices today to:

Kuhlmann Straube Co. Ltd.

Box 358, Oakville, Ont.

Toronto Tel.: CR 8-6211

Please send me: free product catalog and prices

quotation on KSL drafting board cover

name

title

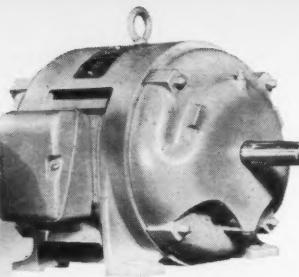
company

address

city

For further information mark No. 141 on Readers' Service Card

It's the
EXTRA
that counts!



Every Brook Motor has extra "copper" to do the specified job. Also *extra* is the fact that every Brook Motor is hydrostatically brake tested. A Brook Motor gives you *extra* economy, *extra* value. No wonder Brook Motors are gaining in popularity every day across Canada. Equal or better than CEMA standards and approved by CSA. Specify a Brook on your next replacement.

SINCE 1904



BROOK ELECTRIC MOTORS

OF CANADA LIMITED/250 University Avenue, Toronto, Ontario

Representatives in: St. John's, Quebec,
 Montreal, Toronto, Guelph, North Bay,
 Winnipeg, Regina, Calgary, Edmonton, Vancouver.

2534

For further information mark No. 108 on Readers' Service Card

- **SPECIALTY SALESMEN**
- **JOBBERS SALESMEN**
- **PENSIONERS**
- **RETIRED MEN**

In line with our subscription sales expansion program, if you have experience as a salesman, branch manager or a background of technical or retail experience, you are invited to answer this advertisement.

If you are in good health and active, we have a few openings in exclusive territories for full-time telephone or field subscription representation. The net earnings of our men average \$75 to \$125 weekly.

Successful applicants will have their choice of franchise or retail, industrial or transportation field, or a combination of these fields, on our business publications. Our full franchise covers forty business publications. Write:

John F. Foy, Circulation Manager,

Business Publications Division
 MACLEAN-HUNTER PUBLISHING CO. LTD.
 481 University Ave., Toronto 2, Ont.

People and events

(Continued from page 85)

Absorbs two companies

Two long-established engineering firms have been acquired by a new Canadian holding company which itself is a subsidiary of a U.S. group.

The two acquisitions are Ross Engineering of Canada Ltd., specialists in the design, fabrication and erection of control equipment for the paper, textile, plastic and other industries, and Surface Industrial Furnaces Ltd., designers, manufacturers and erectors of furnaces for primary metal and metal fabricating plants, etc.

They have become operating divisions of Midland-Ross of Canada Ltd., Montreal, a member of the Midland-Ross Corp., Cleveland, Ohio, whose group directs 14 plants in 12 major cities. The new Canadian companies will be known as Ross of Canada Division and Surface Combustion Division.

Top executives of Midland-Ross of Canada are Ian M. Smellie, J. W. Kennedy and R. R. Willis, all vice-presidents, with Mr. Willis as general manager.

Explains new process

The new welding process known as QuenchWeld was demonstrated in London recently by Canadian welding expert Michael J. Doody during a European tour which included visits to Rome, Paris and Milan.

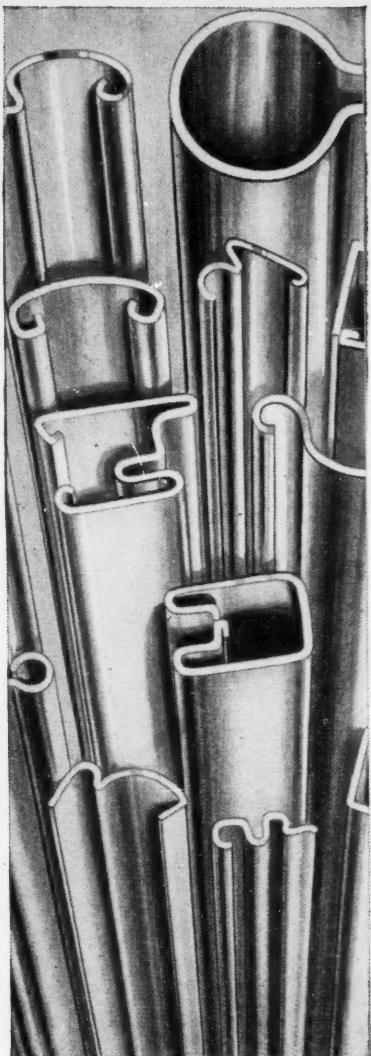
He explained that the new process permits permanent cast iron repairs in one-tenth the normal time without complicated techniques or special equipment. The process, he said, opens the way to quick, permanent repair of nearly 100% of broken cast iron parts.

Mr. Doody is founder of the Eutectic Welding Institute of Canada and currently director of technical services, Eutectic Welding Alloys Co. of Canada Ltd.

Anti-corrosion move

In a move to diversify operations, Canadian Hanson & Van Winkle Co. Ltd. has formed a division dealing with corrosion resistant construction. The division will specify and supply a complete range of cements, plastics and coatings for use in corrosive areas.

T. J. V. Cudbird, P.Eng., formerly chief mechanical engineer of Canadian Hanson, has been named manager of the new division. James Matthew has been named engineering supervisor, a position roughly equivalent to the one Mr. Cudbird previously held.



Custom Cold Roll and Brake Forming

Accurate, economical cold roll forming may solve a problem for you. Let's discuss it.

CRESSWELL POMEROY LIMITED

Head Office & Factory: Granby, Que.
ST. JOHN'S • HALIFAX • QUEBEC CITY
MONTREAL • TORONTO • WINNIPEG
EDMONTON • VANCOUVER

For further information mark No. 116

DESIGN ENGINEERING FEBRUARY 1961

People and events

(Continued)

New design firm

A design consulting firm has been formed by two veterans of the design industry, Clair Stewart and Elliot Morrison. The firm, Stewart & Morrison Ltd., will place first emphasis on packaging, engineering and corporate identification projects, but will quickly add industrial design and engineering.

The company will solicit clients on a retainer basis, but will also work on a spot job basis if the assignment does not conflict with the work of a retainer client. It maintains that Canada has not previously had a firm of design consultants with the experience and resources to undertake major corporate work, and that projects which involve the creation of a complete corporate identity have generally gone to the U.S.

Mr. Stewart was with Rolph-Clark-Stone for 15 years, latterly as director of creative planning. Mr. Morrison headed the package design unit of the same company. Mr. Stewart retains his post on R-C-S's board of directors and that company will use the new firm's services on a retainer basis.

In brief

Philips Electronics Industries Ltd. has re-oriented its Rogers Electronic Tubes and Components Division into two independent departments, one in the consumer products and the other in the professional products field.

A. C. & R. Products Ltd., Scarborough, Ont., have been appointed agents for Alco Valve Co., St. Louis, Mo.

A \$1 million carbon monoxide boiler and extraction steam turbine is being installed in the British American Oil Co.'s Clarkson, Ont., refinery. It will supply power for most of the refinery.

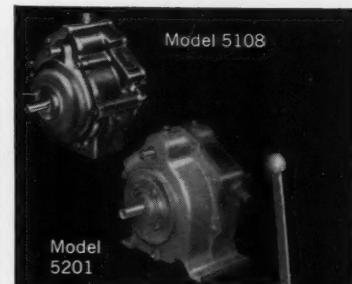
A standard on terminology and definitions has been developed by the Anti-Friction Bearing Manufacturers Association and approved by the American Standards Association.

In the face of strong Canadian and international competition, the English Electric Division of John Inglis Co. Ltd. has won a \$3 million contract for hydraulic turbines for the Manitoba Hydro Electric Board. Delivery will begin in 1962 and the \$140 million Grand Rapids project for which the turbines are destined will go into service in 1964.

(Continued on page 92)

S-N REVERSING TRANSMISSIONS

5 models 8 and 28 h.p.
with power packed
versatility



Model
5231
2 speeds forward

S-N Reversing Transmissions are performance proven, space-saving single units which reverse under full load. Adaptable to the design or redesign of a wide variety of industrial equipment. For technical data write The Snow-Nabstedt Gear Corp., Hamden, Conn.

SPECIFICATIONS

Model No.	5231	5201	5108
Reduction Forward	1.97:1 3.34:1	3.16:1	3.75:1
Ratio Reverse	3.37:1	3.16:1	3.75:1
Power Up To	28 HP	28 HP	8 HP
Max. Input Torque in. lbs.	1000	1000	320
Max. Input Speed RPM	2400	2400	2400
Dimensions	Long Wide High	15 ¹¹ / ₁₆ " 14" 14 ¹ / ₂ "	11 ¹ / ₂ " 13 ¹ / ₂ " 10 ¹ / ₂ "



SNOW-NABSTEDT
Industrial Division
Transmission Engineers
For Over Half a Century

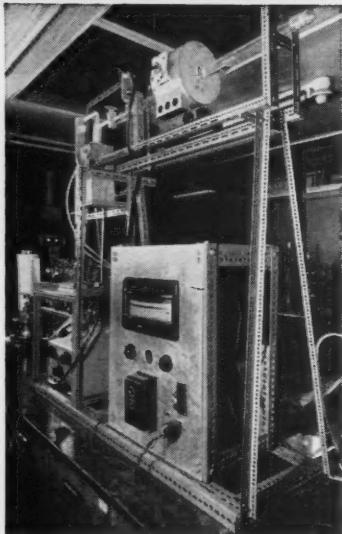
For further information mark No. 154

Build your own equipment with

DEXION



SLOTTED ANGLES



- PALLET RACKING
- CONVEYORS
- FRAMEWORK
- WORK BENCHES
- TABLES
- STORAGE RACKS
- PARTITIONS
- DISPLAY STANDS
- MEZZANINES
- MAINTENANCE PLATFORMS
- MACHINE GUARDS
- DOLLIES
- SHELVING
- CHUTES
- STAIRWAYS
- CATWALKS
- SPECIAL EQUIPMENT

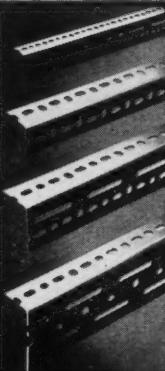
an all-purpose range of 4 SIZES in steel or aluminum

DEXION 112 Midget Size The angle for jobs where great load-bearing capacity is not required.

DEXION 140 Light Duty The equal-flanged DEXION angle for light-duty purposes. For use alone, or combined with DEXION 225 and 300.

DEXION 225 Standard The all-purpose DEXION angle. Combines with DEXION 140 and 300 to solve every equipment problem.

DEXION 300 Heavy Duty The super-rugged angle for use wherever great loads or accidental shock loads must be provided for. Combines with DEXION 225 and 140.



Send this coupon today!

P

DEXION (CANADA) LTD.
114 CLAYSON RD. WESTON, ONT.

Please send free DEXION handbook.
 Please have representative call

NAME _____

COMPANY _____

ADDRESS _____

For further information mark No. 118 on Readers' Service Card

?

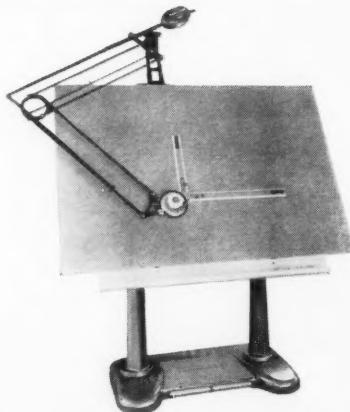
Does your company use Modern Typewriters? Modern Adding Machines? Modern Accounting Machines?

Are you still using inefficient, slow, unhealthy and uneconomical drafting room equipment?

For the price of a good typewriter you get the finest counterbalanced drafting table complete with drafting machine.

Have you discussed the possible savings with management?

NESTLER



New NESTLER 'Regent' 40" x 60" drafting table completely adjustable but eliminating the counterweight.

Less floor space requirements than any other type—the latest and finest of the many NESTLER units available . . .

**ASKANIA Instruments • CORADI
LOTTER • NESTLER • RIEFLER**

request information on drafting equipment and instruments from Canadian distributor

**JAMES W. STEVENSON
AND COMPANY LIMITED**
15 St. Mary Street, Toronto

Toronto:
WA 1-0460

Ottawa Office:
CEntral 4-4374

For further information mark No. 161 on Readers' Service Card

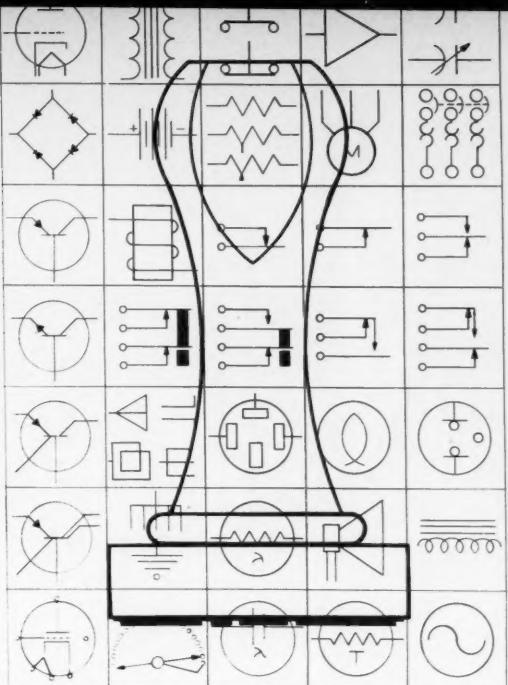
Ideas round-up

continued

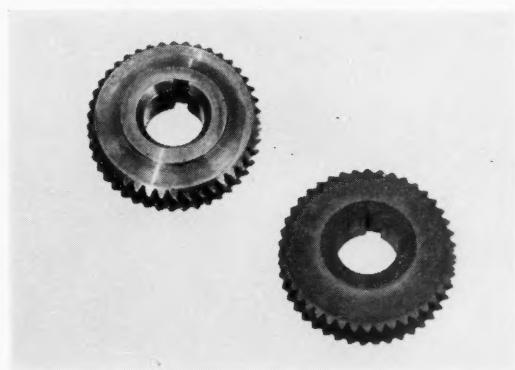
Technical rubber stamps for engineers

Here's something new and interesting: technical rubber stamps which reproduce a complete line of symbols used by engineers, designers, draftsmen and architects. The symbols eliminate tedious detail work and inaccurate rough sketching. Available either individually or in complete sets, they can be used either for layout and design work or as finished drawings to be reproduced by blueprinting or other copy methods.

Among the many classes of symbols currently available are electrical, electronic, relay, welding, heating, ventilating, fluid power, wiring, industrial machinery, static control and construction symbols. The symbols were created from standards established by ASME, ASEE, American Standards Association and the U. S. Bureau of Standards. Source: Paper Equipment Distributing Co.



Five times more wear than bronze

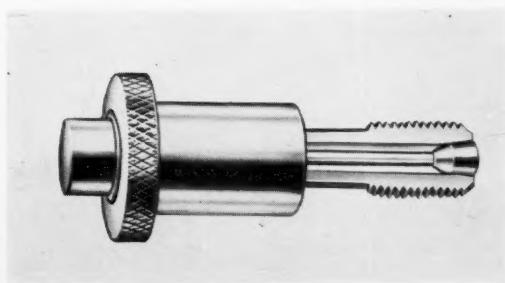


A special grade of laminated plastic has been found a good substitute for bronze in gear applications. A comparison test between the two materials proved that the plastic had at least five times the wear properties of bronze, weighed one sixth as much and could be produced at a 20% cost saving.

The test was in a gear application in a home floor polisher. The substitute material showed good fine-machining characteristics during fabrication, ran quieter than the bronze component and quickly demonstrated its superior wear resistance, according to the manufacturer of the laminated plastic. The plastic substitute is to the left of the bronze gear in the picture. Source: Spaulding Fibre of Canada Ltd.

Quick-release bolt doubles as quick-disconnect fastener

For the first time, the threaded advantages of a bolt are combined with the features of a quick disconnect fastener. Used for tension applications, this unique fastener replaces conventional bolts that are turned into tapped holes or nut plates, wherever speedy assembly or disassembly is necessary. Bolts are engaged or disengaged by releasing or depressing a button that operates a spring-loaded mandrel. The mandrel maintains a positive locked-in contact between threads of tapped holes, or nut threads, with threads on the quick-release bolt. Source: Avdel Inc.



MEEHANITE® MEANS BETTER CASTINGS



By W. H. MOORE
Vice President
Meehanite Metal Corp.

What you should know about Meehanite Metal

WHY THERE IS NO EQUIVALENT

How many times have you been told "I can give you something just as good as Meehanite® and at a lower price" only to find that the castings did not meet your standard of quality.

Actually there is no equivalent for Meehanite metal. Here's why: The exclusive Meehanite process makes use of 32 patented procedures that are essential to the production of highest quality castings and which can be used only by bona fide Meehanite licensees. These procedures relate to all phases of manufacture including processing agents, melting furnaces, sand control, and molding to insure the integrity exhibited by every Meehanite casting. More than 200 Meehanite foundries throughout the world prove the validity of these techniques and share in 35 years of technological know-how that truly puts Meehanite metal in a class by itself.

The production of Meehanite® involves a lengthy training period under the direction of Meehanite engineers, and a continuing program of metallurgical help and advice. Set standards of operation enable Meehanite foundry-men to apply structural control to castings on a day by day basis.

Essentially, the metallurgical control in the production of Meehanite castings involves obtaining a balance between undercooling produced in the melting operation and

nucleation produced by processing the molten metal with alkaline earth agents. The initial degree of undercooling is related to the mass of the casting to be poured and the density and physical properties required. This is then modified by nucleation to force deposition of graphite at exactly the right time during solidification so as to give the right size and shape and distribution to the free graphite at the same time maintaining the character of the metallic matrix. The net result is predictable properties and uniform structure in every section of a casting and from casting to casting.

Gray cast iron made to a chemical specification without benefit of controlled undercooling is influenced by mass effect to a maximum degree and for this and other reasons cannot be considered an equivalent to Meehanite.

There are more than 26 different types of Meehanite metal available, each of which is specifically designed for a given set of service and conditions.

Accept no substitute for Meehanite quality and performance. Specify Meehanite castings and be sure. For more information about Meehanite castings and the foundries making them, write to: *Meehanite Metal Corporation, 714 North Avenue, New Rochelle, New York.*



MEEHANITE METAL

Meehanite Castings Are Made Only By Meehanite Foundries

For further information mark No. 143 on Readers' Service Card

People and events

(Continued from page 89)



Innes



Dawson

Appointments

John H. Innes, P.Eng., has been named sales manager of the Canadian Research Institute. This is a new post and his biggest task will be to convince firms that the job can be done equally effectively in Canada.

Earland M. Dawson, S.Sc., P.Eng., has been promoted chief engineer of Edwards of Canada Ltd. He joined the company in 1953 as electrical engineer.

A. C. Ridgers has been appointed chief design engineer and C. N. Sankey assistant chief design engineer of Consolidated Mining & Smelting Co. of Canada Ltd.

W. Roy Ellis, B.A.Sc., P.Eng., has joined Indiana Steel Products Co. of Canada Ltd. as a sales engineer. He will cover Quebec, the Maritimes and northeast Ontario.

Raymond E. Green has been appointed sales representative in Toronto for the Haydon Division of General Time Corporation, Torrington, Conn. R. Gerald McKee will represent the company in Montreal, Winnipeg and other cities.

George C. Olson has been named works manager of Atlas Steels Ltd. Bruce M. Hamilton becomes manager of metallurgy, the post vacated by Mr. Olson.

For your calendar

March 6-8: National Heating and Air Conditioning Show, Toronto.

March 7-8: Packaging Association of Canada, national conference, King Edward Sheraton Hotel, Toronto.

April 4-6: National Microfilm Association, annual meeting and convention, Sherman Hotel, Chicago.

April 10-21: American Welding Society, annual convention and welding exposition, Sheraton-Atlantic Hotel, New York.

May 3-13: Fifth U. S. World's Fair, Coliseum, New York.

May 17-19: Society for Nondestructive Testing, regional convention, Mount Royal Hotel, Montreal.

Formapex

LAMINATED PLASTICS

Fabric base grades for **ELECTRICAL INSULATION**
Paper base grades for **MECHANICAL PARTS**

- High strength/weight ratio
- High dielectric strength
- Low coefficient of friction
- Resistance to heat, moisture, weak chemicals

FORMAPEX is being used increasingly for terminal boards, control panels, silent gears, bushes, washers, bearings and small mechanical parts. It can be machined or punched, and qualities are made to meet all appropriate British Standard Specifications.

Agents in Canada:

Federal Pacific Electric of Canada, 22 East Fifth Ave., Vancouver 10.

Please write for technical brochure



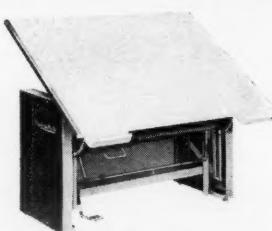
I O C O L I M I T E D

ANNIESLAND, GLASGOW W3, SCOTLAND

Federal Pacific Electric of Canada, P.O. Box 550, 561 Maisonneuve Street, Granby, Que.

For further information mark No. 136 on Readers' Service Card

MAYLINE



DESK-O-MATIC

Tilting Action Completely Balanced!

Adjustable springs on the tilting quadrants of the Mayline Desk-O-Matic and May-O-Matic drafting tables give the draftsman a constant smooth change in angle position of the drafting top, despite any accessories that might have been added to the top edge.

For additional information on this important top tilt control factor, inquire of your local dealer or write to factory. All inquiries answered promptly.

Mayline Company, Inc.

603 No. Commerce St.

Sheboygan, Wisconsin

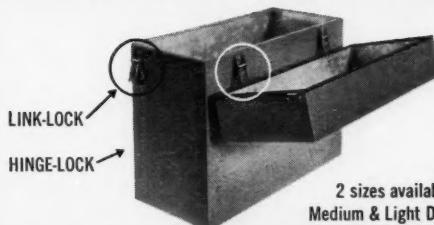


MAY-O-MATIC "E" COMBINATION

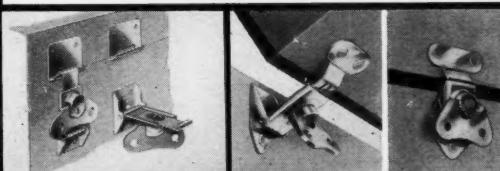
MAYLINE

For further information mark No. 142 on Readers' Service Card
DESIGN ENGINEERING FEBRUARY 1961

Matched hardware for all-around pressure on hinged-cover containers!



2 sizes available:
Medium & Light Duty



LINK-LOCK provides high-strength, pressure-tight seal without springs. A half-turn disengages for opening.

SEND TODAY for complete information.
Engineering service available • Samples on request

HINGE-LOCK permits application of sealing pressure along hinge line; becomes free-operating hinge when released.

SIMMONS FASTENER CORP.
1776 North Broadway, Albany 1, New York

For further information mark No. 155 on Readers' Service Card

backlash

79 Help Wanted—Male	79 Help Wanted—Male	79 Help Wanted—Male	79 Help Wanted—Male	79 Help Wanted—Male	79
ENGINEERS WANTED		CREATIVE DESIGN ENGINEERS		RECENT ENGINEERING GRADUATES	
The Canadian Broadcasting Corporation					
IS SEEKING EXPERIENCED ENGINEERS IN THE FOLLOWING FIELDS:					
2-7693					

The economy improves?

The advertisements above, which appeared in the Toronto Daily Star last month, are an indication that job opportunities for engineers are on the increase, particularly in the design field. Advertisements calling for engineers are not in any way remarkable, but what makes these particular offers interesting is that they appeared side by side in a single newspaper issue (which also carried various other engineering job offers) and that they all called for engineers in the mass. The CBC advertisement asked for three engineers, but the 3M ad on the right and the two from the U. S. did not specify the number of engineers they wanted.

Economists don't use the "engineer indicator" when they foretell the future, but every engineer knows that booming job conditions in this field are a sign of booming economic conditions generally. Engineers are the first to be hired when the economy expands, just as, unfortunately, they are the first to be laid off in hard times.

A forward move

The news that the establishment of a province-wide network of chapters has been approved by the Executive Council of the Association of Professional Engineers of Ontario will be welcomed by most engineers.

The move is designed to bring about an improved system of communications between the Association Executive and its general membership. Chapters will be formed in every large centre in Ontario in order that every member will be able to attend regular meetings without having to travel a great distance. It is expected that between 35 and 40 chapters will be formed.

Membership in the chapters will be open to all APEO members. Chapter chairmen will meet quarterly in Toronto to discuss the affairs of the Association, according to present plans.

Some members of the APEO have been very outspoken about the need for just such a move as this — now let's see how strongly these same members support their local chapters. And by strong support we mean attendance at all chapter meetings!

Ingersoll-Rand Company, A Leader
In Manufacturing Of Precision
Power Tools, Hoists, And Automation
Machinery, Is Seeking For
Diverse, Daring, West Coast
To Be Recognized For Their Creative
Efforts.

Are You Inventive?

UNUSUAL opportunities are open
to you at the West Coast's largest
semiconductor device manu-
facturer, Pacific Semiconductor
Inc., in southeast Los Angeles
area.

IF you're not progressing in your
engineering career, why not
explore what's available here? A
stimulating and challenging
environment, the latest in electronic
devices, and enjoy the
California sun.

THE manufacturer of "Sench" brand
pressure-sensitive tapes, electrical insulating products and
passive components, "Sectra" and
reflective materials, "3M" printing
inks, coated and uncoated adhesives
and coatings, "Thermo-Fax" brand
copying paper and many other products
for recent graduates of an ac-
credited university for both the
plant engineering and the indus-
trial engineering field.

WE are interested in graduates
of mechanical, electrical or chemi-
cal engineering, 23-27 years of
age, interested in becoming as-
sociated with our company
as soon as possible.

QUALI-
TATION
SCIENCE
TESTING
MINUTES
MISSION
APPROVAL
SALARIES
TIONS ARE
UP TO

Confusion over copper

Copper's fluctuating fortunes can be promoted by changing the names of its alloys to indicate their copper base. This is the view of Walter H. Irwin, vice-president, sales and manufacturing, Canada Metal Co. Ltd., and a director of the Canadian Copper & Brass Association.

He says copper's everyday applications are frequently obscured by a lack of proper identity. For example, steel and aluminum products are invariably classified as steel or aluminum, no matter what alloying is involved. Yet the names of copper alloys not only fail to indicate the predominance of their copper content, but frequently lead the uninitiated into thinking they are some other metal.

Thus aluminum bronze is basically copper, with only 3% to 11% aluminum; nickel-silver alloys are basically copper; phosphor bronze contains 90% to 98.75% copper; silicon bronzes contain 94.8% to 96% copper; muntz metal is another name for yellow brass, the copper-base alloy which is the workhorse of the forging trade; gliding metal is 95% copper, and so on.

To make confusion worse confounded, says Mr. Irwin, brasses are sometimes called bronzes. Jewelry bronze, hardware bronze and manganese bronze are really brasses.

Copper's mixed nomenclature, he points out, is due to two basic factors: the desire of manufacturers to protect patented, exclusive combinations of metals and the fact that the scrap-copper market developed its own terminology.

Aeronauts into spacemen

Don't talk about aeronauts and aeronautics. These words are archaic. Who says so? The Institute of Aeronautical Sciences, whose membership is now voting on a change of name to Institute of Aerospace Sciences. The Institute feels that the old name no longer expresses its professional objectives.

When IAC was formed in 1932 its scope was limited to the art or science of operating aircraft on earth-atmosphere flights. Today space-project specialists almost outnumber the old-fashioned kind.

JUST PUBLISHED!

New One-Volume Technical Illustration Course Prepares You For a Rewarding Career Fast!

Here is the authoritative "how to" written by the Publications Engineer of the Nike Systems Project Office at Douglas Aircraft that takes you step by step through skills a technical illustrator needs for success in one of today's most fascinating fields.

You quickly advance from rudiments to more complicated techniques such as cutaways, phantoms, explosions and schematics.

Sample problems encourage practice until you are in command of each skill.



TECHNICAL ILLUSTRATION
by Anthony D. Pyeatt.
Paper bound, 125 illustration-packed pages, 8½" x 11". \$5.00

Get your copy of **TECHNICAL ILLUSTRATION** today.

At your dealer or direct from
HIGGINS INK CO., INC.
271 Ninth St., Brooklyn 15, N. Y.

For further information mark No. 133 on Readers' Service Card

FOR CORROSIVE OR COSTLY FLUIDS OR GASES . . .
GET THE FACTS ON
CHEM-TM LON[®] PACKINGS
FABRICATED FROM DU PONT TEFLON
... acids, alkalis, solvents, toxics, food products up to 600°F.

JOHN CRANE'S line of Chemlon Packing offers an unlimited selection of types, shapes and sizes for practically every service requirement:

...types best suited for valves and automatic regulators.
...for high or low-speed centrifugal, rotary or reciprocating pumps.
...for agitators and mixers.

Here in one bulletin is illustrated and described industry's most complete line of chemically inert packings. You'll save time, trouble and expense on fluid or gas handling problems by requesting Bulletin P-325.



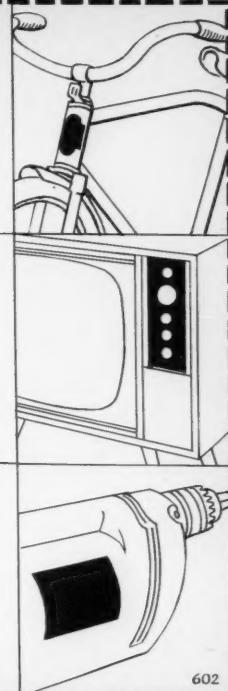
Crane Packaging Company, Ltd.
Box 134, Station C, Dept. AMP, Hamilton, Ont.

For further information mark No. 115 on Readers' Service Card
DESIGN ENGINEERING FEBRUARY 1961

*Save up to 60%
and
enhance appeal!*

with vibrant
self-adhesive
**AVERY
METALLICS**

for
**NAMEPLATES
FUNCTIONAL PARTS
TRIM MATERIALS**



602

DECORATIVE PRODUCTS DIVISION
AVERY ADHESIVE LABEL
48 HAAS RD., REXDALE, ONT.
5369 QUEEN MARY RD., MONTREAL, QUE.
WINNIPEG • VANCOUVER

For further information mark No. 104 on Readers' Service Card

HAVE YOU SEEN PAGE 23?

Pronounce it **DEE** — not **DIE**

- Exclusive distributors for Dietzgen — Ontario and East.
- A complete range of drafting, surveying and printmaking supplies and equipment.
- Call us for service on all drawing office needs.

INSTRUMENTS (1951) LIMITED



14 Adelaide St. W.
Toronto, Ont.
645 Wellington St.
Ottawa, Ont.
4646 Decarie Blvd.
Montreal, Que.
1747 Hamilton St.
Regina, Sask.

For further information mark No. 132 on Readers' Service Card

95

Editorial

Opportunity is knocking at the door

... the draftsman-designer
must prepare for greater
responsibility and effort

The serious and continuing demand for skilled design engineers in this and other countries (see Backlash, one page before this) should result in many opportunities for the draftsman to assume greater responsibility and to advance himself, both in repute and in the pocketbook.

Unfortunately, such is not always the case. In fact, if we were to face the situation squarely, we would have to say it is rarely the case. And it is rarely the case for either one of the following two reasons: management fails to recognize the ability of its men and therefore withholds the opportunity, or the draftsman is not qualified to accept the opportunity the occasional time that it is presented.

Management fails. One of our contributors this month (see "Are draftsmen downgraded in Canada?") speaks out very clearly on this matter. Too many engineers are assigned, either by choice or by management direction, to duties which could better be done by draftsmen or other technicians.

Is it any wonder, then, that our competitors are able to easily outsell us on the foreign markets? They outsell us, in many fields, because we are short on design ideas. Many of our products are direct copies or cheap imitations of the quality products from other lands. We need a Canadian image in design, and that image will only be developed when we release our engineers from many of the lesser tasks which they are now called upon to perform. One solution, and it is readily available to us, is to let the draftsman, and particularly the design draftsman, take over some of the engineer's duties.

The draftsman is not qualified. This is a complaint we hear wherever we go. Very few draftsmen in Canada, we must admit, are as skilled as they could, or should be.

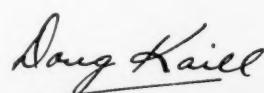
Formal training was probably most inadequate. In many areas high school technical courses (drafting included) are considered to be a refuge for the dullard—and the courses are taught to suit.

Many of the teachers in the high school, technical and college levels are simply bookmasters, or theorists. They have never had any practical experience in the subjects that they teach. How many teachers of drafting, for instance, have actually faced the day-to-day routine of a Canadian drafting office? How long since they made direct contact with the production processes of industry? How many years since they took a refresher course?

Post-school training has been neglected. Are you, if you are employed as a draftsman, making any formal effort to advance your knowledge about engineering in general, and your own job in particular? What do you know about double dimensioning, about drafting standards, and advanced drafting techniques, to mention only three of the subjects covered in this issue? And we repeat the same question we asked exactly one year ago, "When was the last time you read a text on functional drafting?"

Does the company you work for make any special effort to encourage advanced training? Does it sponsor after-work training classes or subsidize the cost of tuition in those subjects you desire to study? If not, then we suggest that this is something you should enquire about.

Your future place in industry will undoubtedly depend upon the amount of effort you put into preparing yourself. Get ready for that opportunity when it comes. We pledge ourselves to encourage management to give you the chance you will thus deserve.



**Use these
cards to get
additional
information...
promptly...
conveniently**

Every advertisement, new product, and catalogue listed in this issue of DESIGN ENGINEERING has been key numbered.

To secure information and literature just circle the proper number on the cards . . . complete and mail . . . we contact the companies for you and pay all the postage.

There are three identical cards . . . pass this copy on so your friends can order material of their choice, too.

**This service
is FREE . . .
make the
most of it.**

BUSINESS REPLY CARD
No Postage Stamp Necessary if Mailed in Canada



Design Engineering

481 University Avenue

Toronto 2, Canada

BUSINESS REPLY CARD
No Postage Stamp Necessary if Mailed in Canada



Design Engineering

481 University Avenue

Toronto 2, Canada

BUSINESS REPLY CARD
No Postage Stamp Necessary if Mailed in Canada



Design Engineering

481 University Avenue

Toronto 2, Canada

Design Engineering

February 1961

Please send me more information on the following circled items:

101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118
 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136
 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154
 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172
 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190
 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205 206 207 208
 300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317
 318 319 320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335
 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353
 354 355 356 357 358 359 360 361 362 363 364 365 366 367 368 369 370 371

PLEASE PRINT or TYPE

CARD INVALID WITHOUT COMPANY NAME

Name Position

Company

Address

Products manufactured

Send DESIGN ENGINEERING for 1 year (\$5) or 2 years (\$9) and bill me later.
 Outside Canada rates: Great Britain & USA \$10 per year—Other countries \$20 per year
 (remittance with order). Please initial

Design Engineering

February 1961

Please send me more information on the following circled items:

101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118
 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136
 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154
 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172
 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190
 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205 206 207 208
 300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317
 318 319 320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335
 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353
 354 355 356 357 358 359 360 361 362 363 364 365 366 367 368 369 370 371

PLEASE PRINT or TYPE

CARD INVALID WITHOUT COMPANY NAME

Name Position

Company

Address

Products manufactured

Send DESIGN ENGINEERING for 1 year (\$5) or 2 years (\$9) and bill me later.
 Outside Canada rates: Great Britain & USA \$10 per year—Other countries \$20 per year
 (remittance with order). Please initial

Design Engineering

February 1961

Please send me more information on the following circled items:

101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118
 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136
 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154
 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172
 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190
 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205 206 207 208
 300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317
 318 319 320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335
 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353
 354 355 356 357 358 359 360 361 362 363 364 365 366 367 368 369 370 371

PLEASE PRINT or TYPE

CARD INVALID WITHOUT COMPANY NAME

Name Position

Company

Address

Products manufactured

Send DESIGN ENGINEERING for 1 year (\$5) or 2 years (\$9) and bill me later.
 Outside Canada rates: Great Britain & USA \$10 per year—Other countries \$20 per year
 (remittance with order). Please initial

ADVERTISERS' INDEX

Key No.	Page No.
101 Armet Industries Limited	82
103 Automatic Electric Sales (Canada) Ltd.	I.B.C.
102 Auto-Ponents Inc.	87
104 Avery Adhesive Label Corp (Canada) Ltd.	95
105 Aviation Electric Limited	78
106 Barden Corp., The	36
107 Bellows-Valvar Ltd.	26
108 Brook Electric Motors of Canada Ltd.	88
109 Brown, David—Foote Gears Ltd.	79
110 Bruning Co., Ltd., Charles	10, 11
111 Canada Metal Co. Ltd.	87
112 Canadian Kodak Co. Ltd.	67
113 Carsen Instruments Ltd.	68
114 Clearprint Paper Co.	18
115 Crane Packing Co. Ltd.	95
116 Cresswell Pomeroy Ltd.	89
118 Dexion (Canada) Ltd.	90
119 Dietzgen of Canada Ltd.	23
120 Dominion Fasteners Ltd.	12, 13
121 Dominion Rubber Co. Ltd.—Naugatuck Chemicals	25
122 Dow Corning Silicones Ltd.	83, 84
123 Du Pont of Canada Ltd.—Photo Products	20
124 Du Pont of Canada Ltd.—Elastomers	8
125 Eagle Pencil Co. of Canada Ltd.	6
126 Fischer Bearings Manufacturing Ltd.	9
127 Garlock of Canada Ltd.	30
128 Gates Rubber of Canada Ltd.	15
129 G.M. Plastic Corp.	22
132 General Analine and Film Corp.—Ozalid Div.	27
130 Heim Co.	4
133 Higgins Ink Co.; Inc.	95
134 Imperial — Eastman Corp.	70
132 Instruments (1951) Limited	95
136 Ioco Ltd.	93
137 Jarry Hydraulics Ltd.	34
138 Jordan, Heinz & Co. Ltd.	74
139 Jordan, Heinz & Co. Ltd.	85
140 Keuffel and Esser of Canada Ltd.	14
141 Kuhlmann Straube Co. Ltd.	87
142 Mayline Co. Inc.	93
143 Meehanite Metal Corp.	93
144 Minnesota Mining and Manufacturing of Canada Ltd.—Photo Copy	16, 17
145 Minnesota Mining and Manufacturing of Canada Ltd.—Adhesives	37
146 Morse Chain of Canada Ltd.	28
147 Noranda Copper and Brass Ltd.	33
148 Northern Electric Co. Ltd.	35
149 Protective Plastics Ltd.	80
150 Reichhold Chemicals Inc.	31
151 Renold Chains Canada Ltd.	38
152 Rockwell Standard Corp. — I.F.C.	
153 Rousseau Controls Ltd.	32
155 Simmons Fastener Corp.	93
154 Snow-Nabstedt Gear Corp.	89
156 Staedtler, J. S. Canada Ltd.	92
157 Standard Tube & T. I. Ltd.	2
158 Steel Co. of Canada Ltd., The	39
159 Steel Co. of Canada Ltd., The	24
160 Stephens-Adamsen Mfg. Co. of Canada Ltd.	40
161 Stevenson and Co. Ltd., James W.	90
162 Stone Franklin of Canada Ltd.	86
163 Thomas & Betts Ltd.	21
165 Timken Roller Bearings Co. O.B.C.	73
164 Torrington Co. Ltd., The	
167 Union Carbide Canada Ltd.—Bakelite Div.	29
166 United Electric Controls (Canada) Ltd.	74
168 United Steel Corp. Ltd.	41
169 Wade Co. Ltd., Norman	19
170 Wagner Electric—Div. of Sangamo Co. Ltd.	81
171 Wagner Electric—Div. of Sangamo Co. Ltd.	75
172 Wagner Electric—Div. of Sangamo Co. Ltd.	77
173 Wallace Barnes Co. Ltd., The	42

CHARACTERISTICS THAT DETERMINE
RELAY SELECTION NO. 1



Class A—a versatile, long life, telephone quality relay.

when first cost is important

Helpful selection data Class A series

CONTACT:

Single or twin

CONTACT CAPACITY:

Normal 3 amps, others available

OPERATING VOLTAGE:

Maximum 250 volts DC

OPERATING TIME:

Range is .002 to .025 seconds

RELEASE TIME:

Range is .005 to .025 seconds

RESIDUAL:

Adjustable or fixed

Variety of contact arrangements available

When you want quality relays that will help you hold down costs, Class A relays by Automatic Electric are your obvious choice. And because these relays are the *original* telephone type, you can be sure of reliable performance and extreme versatility as well.

Where a job calls for unusual spring loads, for instance, or constant high speed operations, Class A relays can be supplied with

heavy duty armature bearings. In addition you have your choice of quick-acting, slow-operating, slow-releasing, and slow-acting types, with single or double pile-ups of up to 20 contact springs.

For versatility, long life, and price, the Class A relay by Automatic Electric is the finest available *anywhere*. Call or write Automatic Electric Sales (Canada) Ltd., 185 Bartley Drive, Toronto 16, Ont. Branches across Canada.

AUTOMATIC ELECTRIC

Subsidiary of
GENERAL TELEPHONE & ELECTRONICS



HOW JOY MOUNTS IDLERS TO FIGHT WEAR FROM DIRT AND DUST



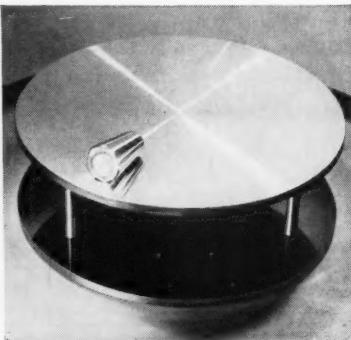
By designing their Limberoller® two-bearing, single-unit catenary idlers to use Timken single-row tapered roller bearings (see above), Joy Manufacturing engineers reduce bearing failures caused by dirt, dust, moisture . . . assure spillage-free conveying and trouble-free idler performance. Timken bearings hold the idlers on center at all times, increase sealing efficiency. Idlers roll easily

under heaviest loads, belt moves smoothly.

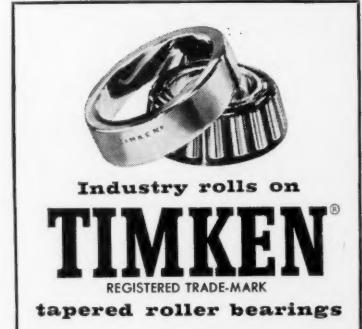
On these applications, Timken bearings assure minimum maintenance, long bearing life because: 1) They hold shafts concentric with housings, making closures more effective in keeping lubricant *in*, dirt *out*. 2) The tapered construction of Timken bearings lets them take radial and thrust loads in any combination.



ENGINEERING SERVICE FOR THE ASKING. Let our Timken bearing salesmen—graduate engineers—tackle your bearing problems, solve them in a hurry. Save you—time and money.



ROLLS FOREVER IN PERFECT CIRCLE on oscillating table, proving the accuracy of its taper. Another demonstration of Timken bearings' precision manufacture that assures trouble-free performance.



Industry rolls on
TIMKEN®
REGISTERED TRADE-MARK
tapered roller bearings

Canadian Timken, St. Thomas, Ontario, Canada. Division of The Timken Roller Bearing Company. Timken bearings manufactured in Canada, Australia, Brazil, England, France and U.S.A.

